THE BULLETIN

OF THE

AMERICAN CERAMIC SOCIETY

Volume 15 OCTOBER, 1936 Number 10

SAMUEL A. WELLER

Mr. Weller started a pottery in 1872 at Fultonham, Ohio, on his father's farm. He moved to Zanesville in 1888. For details of this story, see "The Pottery Industry in Muskingum County, Ohio," page 371.

2,415,411

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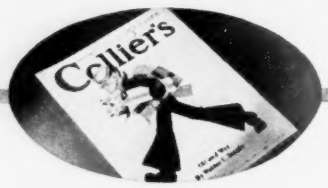

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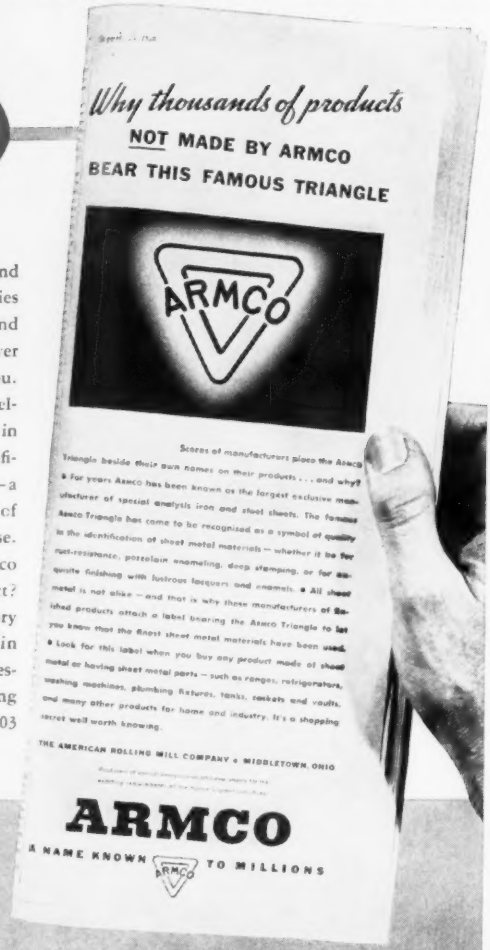
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Volume 15 October, 1936 Number 10

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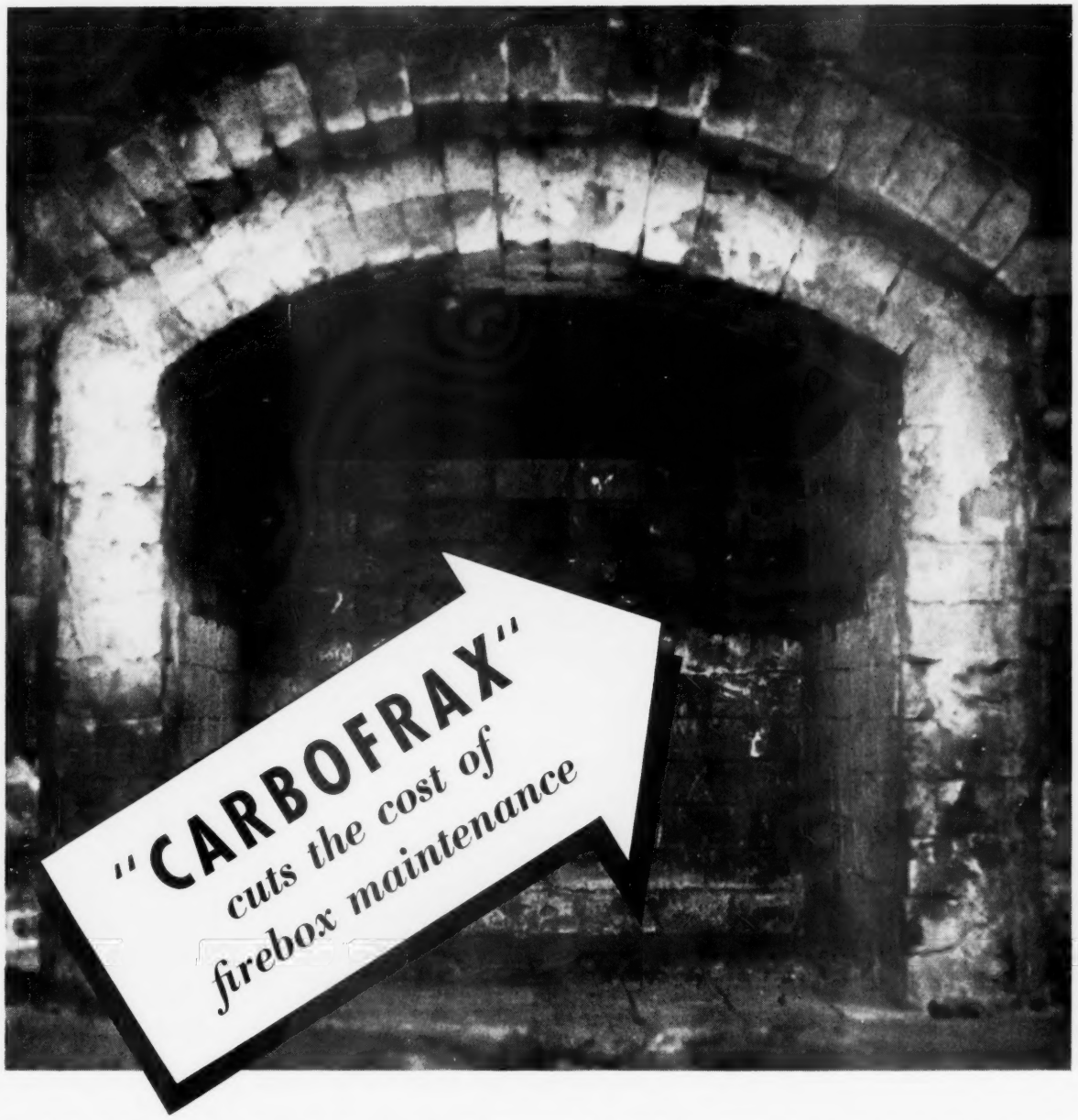

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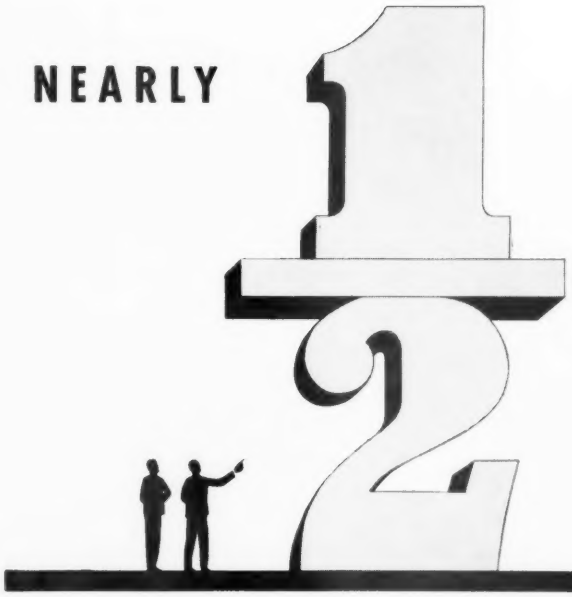

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Lancaster Iron Works, Inc.
Simplex Engineering Co.

Corhart
Corhart Refractories Co.

Cornwall Stone (Imported)
Consolidated Feldspar Corp.
Drakenfeld & Co., B. F.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
Hammill & Gillespie, Inc.
The Hommel Co., O., Inc.
Paper Makers Importing Co.

Crucibles (Filter, Melting, Ignition)
Carborundum Co.
Denver Fire Clay Co.
Norton Co.
Pittsburgh Plate Glass Co.
Potters Supply Co.

Crushers (Clay)
Lancaster Iron Works, Inc.

Crystolon (Refractory Products)
Norton Co.

Cullet, Washing Plants, Incinerators, Crushers
Simplex Engineering Co.

Decorating Supplies
Ceramic Color & Chemical Mfg. Co.
Chicago Vitreous Enamel Product Co.
Drakenfeld & Co., B. F.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
The Hommel Co., O., Inc.
Pittsburgh Plate Glass Co.
The Vitro Mfg. Co.

Disintegrators
Hardinge Company, Inc.
Lancaster Iron Works, Inc.

Dryer (Pipe Rack)
Lancaster Iron Works, Inc.

Drying Machinery
Lancaster Iron Works, Inc.
Simplex Engineering Co.

Electrocast Refractories
Corhart Refractories Co.

Enameling Equipment (Complete)
Ceramic Color & Chemical Mfg. Co.
Chicago Vitreous Enamel Product Co.
The Hommel Co., O., Inc.
Simplex Engineering Co.
The Vitro Mfg. Co.

Enameling Furnaces
Carborundum Co.
Ceramic Color & Chemical Mfg. Co.
Chicago Vitreous Enamel Product Co.
Electro Refractories & Alloys Corp.
The Hommel Co., O., Inc.
Lancaster Iron Works, Inc.
Norton Co.

Enameling Iron (Sheet)
American Rolling Mill Co.
Bethlehem Steel Co.

Enameling Muffles
Bethlehem Steel Co.
Carborundum Co. (*Carbofrax*)
Chicago Vitreous Enamel Product Co.
Electro Refractories & Alloys Corp.
Norton Co. (*Alundum*)
Pittsburgh Plate Glass Co.
Simplex Engineering Co.

Enameling (Practical Service)
Ceramic Color & Chemical Mfg. Co.
Chicago Vitreous Enamel Product Co.
The Hommel Co., O., Inc.
Metal & Thermit Corp.
The Porcelain Enamel & Mfg. Co.
Titanium Alloy Mfg. Co.
The Vitro Mfg. Co.

Enamels
Ceramic Color & Chemical Mfg. Co.
Chicago Vitreous Enamel Product Co.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
The Hommel Co., O., Inc.
Pittsburgh Plate Glass Co.
The Porcelain Enamel and Mfg. Co.
The Vitro Mfg. Co.

Enamel Oxide
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.

Enamels (Porcelain)
Ceramic Color & Chemical Mfg. Co.
Chicago Vitreous Enamel Product Co.
The Hommel Co., O., Inc.
The Porcelain Enamel & Mfg. Co.
Titanium Alloy Mfg. Co.
The Vitro Mfg. Co.

Equipment (Porcelain Enameling)
Ceramic Color & Chemical Mfg. Co.
Chicago Vitreous Enamel Product Co.
The DeVilbiss Co.
Hardinge Company, Inc.
The Hommel Co., O., Inc.

Exhaust Systems
The DeVilbiss Co.

Feldspar
Ceramic Color & Chemical Mfg. Co.
Consolidated Feldspar Corp.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
The Hommel Co., O., Inc.
Paper Makers Importing Co.
The Porcelain Enamel and Mfg. Co.
The Seaboard Feldspar Co.
The Vitro Mfg. Co.

Fire Brick
Carborundum Co.
Corhart Refractories Co.
Denver Fire Clay Co.
Electro Refractories & Alloys Corp.
Norton Co.

Fire Brick—Process Equipment
Lancaster Iron Works, Inc.

Fire Clay
Kentucky Clay Mining Co.
Spinks Clay Co., H. C.

Flint
Ceramic Color & Chemical Mfg. Co.
Consolidated Feldspar Corp.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
The Hommel Co., O., Inc.
Paper Makers Importing Co.
The Porcelain Enamel and Mfg. Co.

Flint Pebbles
Ceramic Color & Chemical Mfg. Co.
Chicago Vitreous Enamel Product Co.
Consolidated Feldspar Corp.
The Hommel Co., O., Inc.
The Vitro Mfg. Co.

Floors (Non-Slip)
Norton Co.

French Flint
Consolidated Feldspar Corp.
Paper Makers Importing Co.

Frit
Allied Engineering Co.
Ceramic Color & Chemical Mfg. Co.
Chicago Vitreous Enamel Product Co.
The Hommel Co., O., Inc.
Porcelain Enamel & Mfg. Co.
Titanium Alloy Mfg. Co.
The Vitro Mfg. Co.

Fuel Oil Systems and Control, Stokers
Bethlehem Steel Co.
Simplex Engineering Co.

Furnaces
Allied Engineering Co.
Carborundum Co. (*Carboradiant*)
Chicago Vitreous Enamel Product Co.
Denver Fire Clay Co.
The Hommel Co., O., Inc.
Simplex Engineering Co.

Glass Bending Ovens, Glass Decorating Machines
Simplex Engineering Co.

Glass Equipment
Hartford-Empire Co.
Lancaster Iron Works, Inc.

Glass Melting Pots (Open and Covered)
Pittsburgh Plate Glass Co.

Glass Melting Tanks and Furnaces
Pittsburgh Plate Glass Co.
Simplex Engineering Co.

Glass Thickness Gauge
Bausch & Lomb Optical Co.

Glaze and Body Spar
Ceramic Color & Chemical Mfg. Co.
Consolidated Feldspar Corp.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
The Hommel Co., O., Inc.
Paper Makers Importing Co.
The Porcelain Enamel and Mfg. Co.
The Vitro Mfg. Co.

Glazes and Enamels
Ceramic Color & Chemical Mfg. Co.
Chicago Vitreous Enamel Product Co.
Drakenfeld & Co., B. F.
Du Pont de Nemours, E. I., & Co., Inc., R. H. Chemicals Dept.
The Hommel Co., O., Inc.
Ingram-Richardson Mfg. Co. of Indiana, Inc.
The Porcelain Enamel & Mfg. Co.
Titanium Alloy Mfg. Co.
The Vitro Mfg. Co.

Glaze Spar
Ceramic Color & Chemical Mfg. Co.
Consolidated Feldspar Corp.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
The Hommel Co., O., Inc.
Paper Makers Importing Co.

Goggles
Willson Products, Inc.

Gold
Ceramic Color & Chemical Mfg. Co.
Drakenfeld & Co., B. F.
Du Pont de Nemours, E. I., & Co., Inc. R. H. & Chemicals Dept.
The Hommel Co., O., Inc.
The Vitro Mfg. Dept.

Gold Decorations
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Co.

Granulators
Hardinge Company, Inc.
Lancaster Iron Works, Inc.

Grinding Wheels
Carborundum Co. (*Carborundum and Aloxite*)
Chicago Vitreous Enamel Product Co.
Norton Co. (*Alundum-Crystolon*)

Hearths
Carborundum Co. (*Carbofrax* heat treating)
Corhart Refractories Co.
Electro Refractories & Alloys Corp.
Norton Co. (*Crystolon*)

Hearths (Fused Al_2O_3, SiC)
Electro Refractories & Alloys Corp.

Hearths (High Aluminous Clay, Electrically Sintered Aluminum Oxide, Silicon Carbide)
Carborundum Co.
Norton Co.

Hose (Air and Fluid)
The DeVilbiss Co.

Iron (Enameling)
American Rolling Mill Co.
Bethlehem Steel Co.

Iron Oxide
Ceramic Color & Chemical Mfg. Co.
Drakenfeld & Co., B. F.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
The Hommel Co., O., Inc.
The Porcelain Enamel and Mfg. Co.
The Vitro Mfg. Co.

Kaolin
Ceramic Color & Chemical Mfg. Co.
Consolidated Feldspar Corp.
Edgar Brothers Co.
Edgar Plastic Kaolin Co.
Hammill & Gillespie, Inc.

The Hommel Co., O., Inc.
Paper Makers Importing Co.
United Clay Mines Corp.
The Vitro Mfg. Co.

Kellog AA Refractories
Electro Refractories & Alloys Corp.

Kilns, China (Decorating)
Allied Engineering Co.
Denver Fire Clay Co.
Drakenfeld & Co., B. F.
The Hommel Co., O., Inc.
Simplex Engineering Co.

Kiln Furniture (Silicon Carbide, Semi-Silicon Carbide)
Electro Refractories & Alloys Corp.

Kyanite
Celo Mines, Inc.

Kryolith
Ceramic Color & Chemical Mfg. Co.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
The Hommel Co., O., Inc.
The Vitro Mfg. Co.

Laboratory Ware
Norton Co.

Lehr Tile (High Aluminous Clay, Electrically Sintered Aluminum Oxide, Silicon Carbide)
Carborundum Co.
Electro Refractories & Alloys Corp.

Lehrs
Simplex Engineering Co.

Lehrs (Electric or Fuel Heated)
Simplex Engineering Co.

Lehr Loaders
Simplex Engineering Co.

Linings (Furnace Refractory, Block Refractory Plate, Brick and Tile)
Carborundum Co.
Chicago Vitreous Enamel Product Co.
Corhart Refractories Co.
Denver Fire Clay Co.
Electro Refractories & Alloys Corp.
Norton Co.
Pittsburgh Plate Glass Co.
The Vitro Mfg. Co.

Magnesia (Fused)
Electro Refractories & Alloys Corp.

Magnesia (Sintered, Calcined)
Drakenfeld & Co., B. F.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
The Hommel Co., O., Inc.
Norton Co.
The Procelain Enamel and Mfg. Co.

Magnesite
Ceramic Color & Chemical Mfg. Co.
Drakenfeld & Co., B. F.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
Hammill & Gillespie, Inc.
The Hommel Co., O., Inc.
The Vitro Mfg. Co.

Manganese
Ceramic Color & Chemical Mfg. Co.
Drakenfeld & Co., B. F.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
Hammill & Gillespie, Inc.
The Hommel Co., O., Inc.
The Vitro Mfg. Co.

Manganese (Oxide)
Ceramic Color & Chemical Mfg. Co.
Corhart Refractories Co.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.

Masks (Breathing)
The DeVilbiss Co.
Willson Products, Inc.

Metals (Porcelain Enameling)
American Rolling Mill Co.
Bethlehem Steel Co.

Microscopes (Polarizing)
Bausch & Lomb Optical Co.

Minerals
Ceramic Color & Chemical Mfg. Co.
Drakenfeld & Co., B. F.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
Hammill & Gillespie, Inc.
The Hommel Co., O., Inc.
The Vitro Mfg. Co.

Mixers (Batch)
Lancaster Iron Works, Inc.

Mold Sanders
Lancaster Iron Works, Inc.

Muffles (Furnace)
Allied Engineering Co.
Carborundum Co. (*Carbofrax*)
Chicago Vitreous Enamel Product Co.
Denver Fire Clay Co.
Electro Refractories & Alloys Corp.
Norton Co.
Pittsburgh Plate Glass Co.
Simplex Engineering Co.

Muffles (Laboratory)
Electro Refractories & Alloys Corp.

Mullite (Refractories)
Electro Refractories & Alloys Corp.

Muriatic Acid
Denver Fire Clay Co.
The Hommel Co., O., Inc.

Nitrates (Cobalt, Sodium)
Ceramic Color & Chemical Mfg. Co.
Drakenfeld & Co., B. F.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
The Hommel Co., O., Inc.
The Vitro Mfg. Co.

Non-Gro Refractories
Electro Refractories & Alloys Corp.

Norbide (Norton Boron Carbide)
Norton Co.

Olivine
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.

Opacifiers
Ceramic Color & Chemical Mfg. Co.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
The Hommel Co., O., Inc.
Ingram-Richardson Mfg. Co. of Indiana, Inc.
Metal & Thermit Corp.
The Porcelain Enamel & Mfg. Co.
Titanium Alloy Mfg. Co.
The Vitro Mfg. Co.

Overglaze Colors
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.

Oxides
Ceramic Color & Chemical Mfg. Co.
Chicago Vitreous Enamel Product Co.
Drakenfeld & Co., B. F.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
Ingram-Richardson Mfg. Co. of Indiana, Inc.
Metal & Thermit Corp.
Porcelain Enamel & Mfg. Co.
Titanium Alloy Mfg. Co.
The Vitro Mfg. Co.

Palladium Decorations
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.

Pins
Chicago Vitreous Enamel Product Co.
The Hommel Co., O., Inc.
Ingram-Richardson Mfg. Co. of Indiana, Inc.
Potters Supply Co.

Platinum Decorations
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.

Polariscopes
Bausch & Lomb Optical Co.
Simplex Engineering Co.

Porcelain Enameling Service (Practical)
American Rolling Mill Co.
Ceramic Color & Chemical Mfg. Co.
Chicago Vitreous Enamel Product Co.
Hardinge Company, Inc.
The Hommel Co., O., Inc.
The Porcelain Enamel & Mfg. Co.
Titanium Alloy Mfg. Co.
The Vitro Mfg. Co.

Porcelain Enamels
Ceramic Color & Chemical Mfg. Co.
Chicago Vitreous Enamel Product Co.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
Ingram-Richardson Mfg. Co. of Indiana, Inc.
The Porcelain Enamel & Mfg. Co.
Titanium Alloy Mfg. Co.
The Vitro Mfg. Co.

Potash (Carbonate)
Ceramic Color & Chemical Mfg. Co.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
The Hommel Co., O., Inc.
Solvay Sales Corp.
The Vitro Mfg. Co.

Producer Glass Plants
Simplex Engineering Co.

Pug Mills
Lancaster Iron Works, Inc.

Pyrophyllite
The Seaboard Feldspar Co.

Pyrometer Tubes
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Pyrometer Tubes (Refractory and Hard Porcelain)
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Montgomery Porcelain Products Co.
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Pyrometers (Optical, Radiation, Surface, Immersion, Needle)
Pyrometer Instrument Co.

Pyrometric Cones
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Raw Material Handling Equipment
Simplex Engineering Co.
Lancaster Iron Works, Inc.

Refractometers
Bausch & Lomb Optical Co.

Refractories
Carborundum Co.
Corhart Refractories Co.
Denver Fire Clay Co.
Electro Refractories & Alloys Corp.
Kentucky-Tennessee Clay Co.
Norton Co.
Pittsburgh Plate Glass Co.

Refractory Materials
Carborundum Co.
Chicago Vitreous Enamel Product Co.
Corhart Refractories Co.
Denver Fire Clay Co.
Electro Refractories & Alloys Corp.
Kentucky-Tennessee Clay Co.
Norton Co.
Pittsburgh Plate Glass Co.
Titanium Alloy Mfg. Co.

Represses (Automatic)
Lancaster Iron Works, Inc.

Respirators
Chicago Vitreous Enamel Product Co.
The DeVilbiss Co.
The Hommel Co., O., Inc.
Willson Products, Inc.

Rutile
Ceramic Color & Chemical Mfg. Co.
Drakenfeld & Co., B. F.
Du Pont de Nemours, E. I., & Co., Inc. R. & H. Chemicals Dept.
The Hommel Co., O., Inc.
Metal & Thermit Corp.
Titanium Alloy Mfg. Co.
The Vitro Mfg. Co.

Saggers
Carborundum Co.
Electro Refractories & Alloys Corp.
Norton Co.
Potters Supply Co.

Salt Cake
American Potash & Chemical Co.
The Hommel Co., O., Inc.

Sandblast Helmets
Willson Products, Inc.

Sand Grinder and Sifters
Lancaster Iron Works, Inc.

Saponin
The Hommel Co., O., Inc.

Selenite of Sodium
Drakenfeld & Co., B. F.
The Hommel Co., O., Inc.
The Vitro Mfg. Co.

Selenium
Ceramic Color & Chemical Mfg. Co.
Drakenfeld & Co., B. F.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
The Hommel Co., O., Inc.
The Vitro Mfg. Co.

Sheets (Enameling Iron)
American Rolling Mill Co.
Bethlehem Steel Co.

Silica (Fused)
Electro Refractories & Alloys Corp.
The Hommel Co., O., Inc.

Silicate of Soda
Ceramic Color & Chemical Mfg. Co.
Denver Fire Clay Co.
The Hommel Co., O., Inc.

Silicon Carbide
Carborundum Co.
Electro Refractories & Alloys Corp.
Norton Co.

Silicon Carbide Firesand
Carborundum Co.

Sillimanite Refractories
Electro Refractories & Alloys Corp.

Sillimanite (Synthetic)
Pittsburgh Plate Glass Co.

Slabs (Furnace)
Carborundum Co.
Electro Refractories & Alloys Corp.
Ingram-Richardson Mfg. Co. of Indiana, Inc.

Norton Co.
Pittsburgh Plate Glass Co.

Soda Ash
American Potash and Chemical Corp.
Ceramic Color & Chemical Mfg. Co.
Denver Fire Clay Co.
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Sodium Antimonate
Ceramic Color & Chemical Mfg. Co.
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Sodium Fluoride
Ceramic Color & Chemical Mfg. Co.
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Drakenfeld & Co., B. F.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
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Ceramic Color & Chemical Mfg. Co.
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The Hommel Co., O., Inc.

Soot Blowers
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Special Machines
Simplex Engineering Co.

Spar
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Consolidated Feldspar Corp.
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The Hommel Co., O., Inc.
Paper Makers Importing Co.
The Vitro Mfg. Co.

Spray Booths
The DeVilbiss Co.

Spraying Equipment
The DeVilbiss Co.

Spurs
Potters Supply Co.

Stacks
Lancaster Iron Works, Inc.

Steel Plate Construction
Bethlehem Steel Co.
Lancaster Iron Works, Inc.

Stilts
Potters Supply Co.

Sulfuric Acid
Denver Fire Clay Co.
The Hommel Co., O., Inc.

Talc
Ceramic Color & Chemical Mfg. Co.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
Hammill & Gillespie, Inc.
The Hommel Co., O., Inc.
Paper Makers Importing Co.

Tanks
Simplex Engineering Co.

Tank Blocks
Corhart Refractories Co.
Pittsburgh Plate Glass Co.

Tanks (Pickle)
Chicago Vitreous Enamel Product Co.
The Hommel Co., O., Inc.

Tanks for Raw Material Steel or Concrete
Bethlehem Steel Co.
Lancaster Iron Works, Inc.

Tile (Floor)
Norton Co.

Tile (Muffle)
Carborundum Co.
Electro Refractories & Alloys Corp.
Norton Co.

Tile (Refractory)
Carborundum Co. (*Carbofrax*)
Chicago Vitreous Enamel Product Co.
Denver Fire Clay Co.
Electro Refractories & Alloys Corp.
Norton Co.
Pittsburgh Plate Glass Co.

Tile (Wall)
Denver Fire Clay Co.

Tin Oxide
Ceramic Color & Chemical Mfg. Co.
Drakenfeld & Co., B. F.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
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Metal & Thermit Corp.
The Vitro Mfg. Co.

Titanium
Ceramic Color & Chemical Mfg. Co.
Drakenfeld & Co., B. F.
The Hommel Co., O., Inc.
Titanium Alloy Mfg. Co.
The Vitro Mfg. Co.

Titanium Oxide
Ceramic Color & Chemical Mfg. Co.
Drakenfeld & Co., B. F.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
The Hommel Co., O., Inc.
Metal & Thermit Corp.
Titanium Alloy Mfg. Co.
The Vitro Mfg. Co.

Trucks
Lancaster Iron Works, Inc.

Tubes (Insulating)
Carborundum Co.
McDanel Refractory Porcelain Co.
Norton Co.

Tubes (Pyrometer)
Carborundum Co.
Denver Fire Clay Co.
Electro Refractories & Alloys Corp.
McDanel Refractory Porcelain Co.
Montgomery Porcelain Products Co.
Norton Co.
Pittsburgh Plate Glass Co.

Uronium Oxide (Yellow-Orange-Black)
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
The Vitro Mfg. Co.

Water Softening Plants
Simplex Engineering Co.

Wet Enamel
Ceramic Color & Chemical Mfg. Co.
Chicago Vitreous Enamel Product Co.
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The Porcelain Enamel & Mfg. Co.
Titanium Alloy Mfg. Co.
The Vitro Mfg. Co.

Whiting
Ceramic Color & Chemical Mfg. Co.
Drakenfeld & Co., B. F.
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Hammill & Gillespie, Inc.
The Hommel Co., O., Inc.
Paper Makers Importing Co.
The Vitro Mfg. Co.

Winding Drums
Lancaster Iron Works, Inc.

Zinc Oxide
Ceramic Color & Chemical Mfg. Co.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
The Hommel Co., O., Inc.
The Vitro Mfg. Co.

Zirconia
Ceramic Color & Chemical Mfg. Co.
Du Pont de Nemours, E. I., & Co., Inc., R. & H. Chemicals Dept.
The Hommel Co., O., Inc.
Metal & Thermit Corp.
Titanium Alloy Mfg. Co.
The Vitro Mfg. Co.

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PAPERS

REVIEW OF DATA ON COMBUSTION IN KILNS*

By W. E. Rice

Abstract

This paper shows that the supposed discrepancies in previously published conclusions are only apparent and not real.[1] The control of secondary air needed to obtain long flame in periodic kilns is discussed. More frequent firing of alternate fire boxes is recommended. Furthermore, the value of admitting into the "bag wall" a portion of the secondary air needed for complete combustion rather than passing all of it over the fuel bed is shown.

I. Introduction

The purpose of this paper is to review and discuss principles of and data on the combustion, in the space beyond the bed, of the combustibles in gases from a fuel bed, and to relate these principles and data to the firing of ceramic kilns.

The quantity and composition of combustibles in these gases are determined by actions in the fuel bed. The principles of the actions that occur in overfeed-fuel beds (as exemplified by hand-fired beds) have been established by experimental data.[2] The data given in these publications are for a section of fuel bed without holes, removed from the cooling effect of walls, and with little loss of heat by radiation from the top surface. These and other publications establish that under the foregoing restrictions all of the oxygen in the air is used in the first few inches of the live bed, which excludes ash below the bed; the distance varies with the type and size of the fuel, temperature of the air, and, to some extent, with the depth of the bed and the rate at which air is supplied. With air preheated to 800°F, all of the oxygen was used in $1^1/_2$ inches, but in industrial furnaces under normal conditions this distance is 3 to 6 inches.

The unburned combustible in gases leaving the fuel bed may be a large proportion of the combustible in the fuel; the amount can be predicted fairly closely from experimental data for any given fuel, size, depth of bed, and rate of air supply. The results of an investigation of the burning of various solid fuels in fuel beds, 6 and 12 inches deep, have been published.[2a] It is shown that the gases that left a 6-inch bed of screenings of Pittsburgh coal contained 28%, by volume, combustible gases. This might be equivalent to undeveloped heat of 56% of the available heat in the coal, and to complete the combustion and allow 15% excess air would require 1.2 times as much air as passed through the fuel bed and was used to gasify the coal. This is but one illus-

* Contribution by the Pittsburgh Experiment Station, U. S. Bureau of Mines, Pittsburgh, Pa.

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Presented at the Annual Meeting, American Ceramic Society, Columbus, Ohio, March 30, 1936 (Ceramic Ware Firing Symposium). Received February 27, 1936.

[1] *E.g.*, see *Bull. Amer. Ceram. Soc.*, **14** [12] 398–99(1935).

[2] These are typified by those given by (*a*) Henry Kreisinger, F. K. Ovitz, and C. E. Augustine, "Combustion in the Fuel Bed of Hand-Fired Furnaces," *U. S. Bur. Mines Tech. Paper*, No. 137, 76 pp. (1st ed., 1916, revised ed., 1917); (*b*) Henry Kreisinger, C. E. Augustine, and S. H. Katz, "Low-Rate Combustion in Fuel Beds of Hand-Fired Furnaces," *ibid.*, No. 139, 54 pp. (1918).

tration; the data were not the same for all fuels or sizes.

These data were determined experimentally under the restrictions previously stated, and the reports emphasize that the average combustible for the whole area of a bed may often be much lower because of less intense combustion at the walls and because oxygen gets through holes in the bed or at the walls. The statements concerning gases that represented 60% undeveloped heat have been quoted as though they applied to any type of fuel bed or furnace, with no consideration given to the qualifications included in the full discussion. Publications on proprietary "secondary-air" devices have often contained such misleading statements.

High averages over the whole bed, can be maintained, however, by careful firing and attention, and, as exemplified by the gas producer, the amount of combustible gas can be made still higher by increasing the depth of the bed, provided there is enough draft to move air through it at the necessary rate.

To make complete studies of the progress of combustion in the space beyond the fuel bed is a long and costly undertaking. Fuel beds in industrial furnaces rarely burn uniformly. Usually the secondary air must be admitted outside the limits of the area of the bed; it may enter at more than one place (intentionally or by leakage) and the path of the gases may be tortuous. Only rarely can the probable course of one stream of gas be predicted. The average change in composition at successive cross-sections requires the collection and analysis of a number of samples at each section, which procedure is costly and may not be accurate because of lack of knowledge of the mass velocity of the gases at each sampling position. Therefore, few thorough investigations have been made and many would not be warranted because of the many variable conditions. Single samples at positions assumed to be representative of each cross-section usually suffice.

The special equipment used for these combustion[3] tests was a straight horizontal combustion chamber, 3 feet square in section and about 40 feet long, lined with refractories, and fired with a Murphy stoker. The straight chamber was used so that stratification of the gas streams could occur, although the gases made a right-angle turn after they left the fuel bed. Many and complete tests are reported for three coals and the variables are the rates of burning and quantities of excess air.

The tests showed that stratification occurred with this design of furnace and combustion chamber and that combustion continued as the stream flowed through the chamber. The two broad conclusions from these tests were as follows: (1) that the rate of combustion increased with the amount of excess air supplied; *e.g.*, with 60% excess air, combustion might be completed in 15 feet; but with only 10% excess, there might still be unburned combustible at 40 feet (the end of the chamber) and (2) that with the same excess air, the rate of combustion differed for the coals tested and depended upon the quality of the volatile matter expelled from them by heat. The rate was slower, as the gases contained more heavy hydrocarbons, tar, and soot; thus, combustion was more rapid with Pocahontas than with Pittsburgh coal. The analyses given in the report are the averages at each cross-section.

Figure 1 has been reproduced many times.[4] It does not conform to any specific test but was used to typify the principles of the actions that occur in a fuel bed and combustion space. It represents a fuel bed 6 inches thick and the first 7 feet of combustion space; it shows incomplete combustion at 7 feet. Considering the action in the combustion space, the composition of the gases at several sampling positions in the stream are shown in percentage by volume of CO_2, O_2, and combustible gases. The first 5 feet of the stream is in the furnace, where it was not possible to collect samples representative of the average because the gases moved in irregular paths and with widely different velocities; the samples therefore favored the gases from the fuel bed and did not include streams that contained much secondary air. From the diagram, it is easy to compute how much secondary air was added to the gas stream, and a curve has been added to the figure to show this; it shows the total weight of air supplied per pound of combustible in the coal burned.

Bulletin No. 135 explains that the exact results obtained apply to the design of furnace used and to the conditions of the tests and that the speed of combustion could have been increased by imposing a more rapid admixture of the secondary air and gases. Other publications of the Bureau of Mines give experimental data on furnaces in industrial plants.

In boiler furnaces, the problem usually is to obtain complete combustion in the smallest volume of combustion space by rapid mixture

[3] For the most complete study that has been made on the progress of combustion see Henry Kreisinger, C. E. Augustine, and F. K. Ovitz, "Combustion of Coal and Design of Furnaces," *U. S. Bur. Mines Bull.*, No. 135, 144 pp. (1917).

[4] Reproduced from *Bur. Mines Tech. Paper*, No. 137, and *Bur. Mines Bull.*, No. 135 (see footnotes 2*a* and 3).

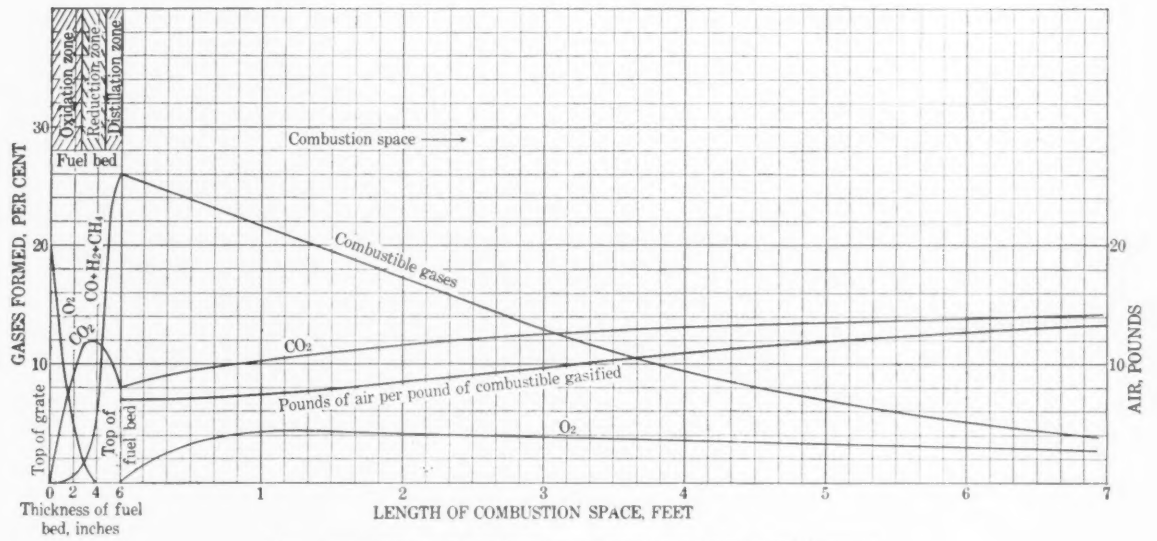

FIG. 1.—Process of combustion of coal in a hand-fired furnace.

of the gases, but in industrial furnaces the problem often is to delay combustion in order to release heat over a long path of travel of the gases. Many investigators have studied industrial furnaces but, in most instances, gaseous fuels were used.

If solid fuel is powdered, the surface available for contact with oxygen is increased so greatly that combustion can occur at an explosive rate; but the rate of burning of powdered fuel depends also upon the way the air is mixed with it. Thus, in some boiler furnaces short flames are obtained by turbulent mixing, whereas in industrial furnaces, such as air furnaces for malleable iron and cement kilns, long luminous flames are obtained by less turbulent mixture of fuel and air. In cement kilns this is done to obtain the necessary transfer of heat to clinker without excessive damage to refractory linings.[5]

Slow combustion and, consequently, long flame are obtained with natural and other fuel gas by the use of diffusion burners, which introduce the gas and air to the combustion chamber in quietly flowing parallel streams that mix slowly; on the other hand, by means of surface combustion,[6] which simulates the conditions that exist in a fuel bed, rates of burning as high or higher than occur in fuel beds can be obtained because an extremely intimate mixture and a forcible contact of oxygen and combustible are obtained.

Coke-oven and producer gas are more closely analogous to the gases that leave a fuel bed than is natural gas. Experiments with coke-oven gas by Pistor[7] showed that "the length of flame is determined entirely by the degree of thoroughness of the mixing of the gas and air and by the amount of air; the more thorough the mixing and the higher the air excess within the usual limits, the shorter will be the flame."

In open-hearth furnaces the length of flame is adjusted by control of the rate of contact of air and fuel; mixing is controlled here by the ratio of air to gas admitted and by the way in which the streams of air and gas meet as established by the construction of the ports.[8]

Many zinc-distillation furnaces are fired with producer gas.[9] In these furnaces clay retorts are heated to 2200 to 2300°F in combustion chambers from 40 to more than 100 feet long. At one end of the combustion chamber, hot raw producer gas is admitted and a flame the full length of the chamber is maintained by adding increments of air through small ports situated at about 5-foot intervals. Figure 2 (from data given by Mül-

[5] H. P. Reid, "Use of Fuel in the Manufacture of Portland Cement," *Trans. A.S.M.E.*, **52,** FSP-52-17 (1930); *Ceram. Abs.*, **9** [9] 712 (1930).

[6] R. T. Haslam and R. P. Russell, Fuels and Their Combustion, p. 304. McGraw-Hill Book Co., New York, N. Y., 1926. 908 pp.; *Ceram. Abs.*, **5** [7] 226 (1926).

[7] R. Pistor, "A Study of the Process of Combustion in Gas-Fired Installations," *Arch. Eisenhüttenw.*, **4** [12] 563–76 (June, 1931).

[8] W. P. Chandler, Jr., "Open-Hearth Combustion," *Proc. Engrs.' Soc. West. Pa.*, **46,** 241–63 (Oct., 1930).

[9] W. R. Ingalls, The Metallurgy of Zinc and Cadmium. McGraw-Hill Book Co., New York, N. Y., 1906. 701 pages.

haueser[10]) shows the uniformity of temperature thus maintained.

In many ceramic kilns fired with solid fuel, long flame is sought in order to heat the kilns rapidly and uniformly. Accomplishment of this objective requires that the furnaces be operated,

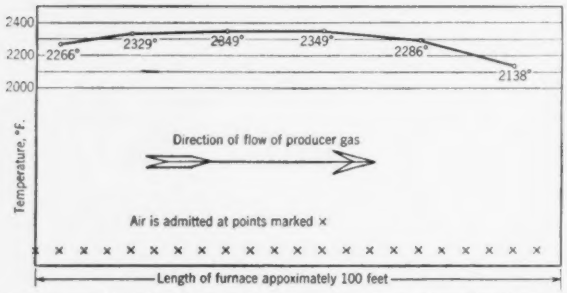

FIG. 2.—Distribution of temperature in a zinc distillation furnace.

first, so that they produce much combustible gas, that is, with deep fuel beds, and second, so that this gas is mixed slowly with the air necessary to burn it. This method, which is also used in many metallurgical furnaces, has been termed "semi-gas firing" by Wesemann,[11] who made a study of it. In most furnaces of kilns, however, the air admitted over the fuel bed enters in streams that are flowing horizontally when they enter the combustion chamber, whereas the combustible gases are rising vertically from the fuel bed; this is the first factor that conduces to early mixing. A second factor is that, except for a period of a few minutes just after the firing of fresh coal, the amount of air admitted may be as much as 100% in excess of the amount necessary to complete the combustion, thus increasing the concentration of oxygen in the mixture. A third factor is that the combustible gases and air impinge on the crown of the kiln and change the direction of flow a short distance above the top of the bag wall. Repeated observations in a rectangular paving-brick kiln, in the ends of which peepholes were provided just above the level of the tops of the bag walls, showed that for not more than a minute after the firing of an individual furnace luminous flame sometimes reached nearly to the center of the crown; for the next five minutes the luminous flame did not extend more than two feet from the turn of the crown; thereafter no flame was visible. (This kiln was fired with Middle Kittanning coal, Ohio No. 6 seam.) The kilns in which the Bureau of Mines made special studies of the combustion of gases had furnaces that were not equipped with doors at the firing openings to control the amount of air admitted over the fuel bed; the admission of air therefore was controlled by the manner of piling coal in the firing openings. In such hand-fired furnaces, the rapidity of mixing the air and gases in the furnace is increased when much ash accumulates, the fuel bed becomes thick, or from any other cause the resistance of the fuel bed becomes high, for then much of the force of the available draft is expended in drawing air through the small openings over the fire, with the result that a large proportion of the total air enters here in jets and mixes quickly with the combustible gases, so that rapid burning and hot furnaces result.

The Bureau of Mines made studies to determine the rate of burning of combustible gases beyond the fuel beds in two kilns in which attempts were made to obtain long flames.[12]

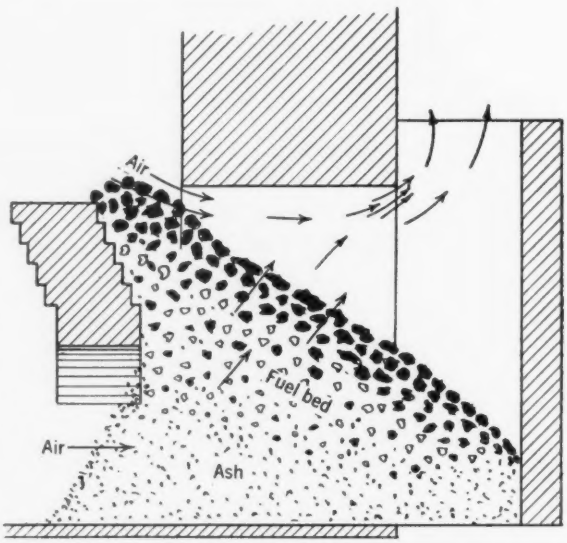

FIG. 3.—Hand-fired dead-bottom furnace of kiln No. 7. This shows the probability of rapid mixing of air and gas and hence rapid combustion near the fuel bed.

The analyses of the gases showed that the desired delayed combustion was not obtained in either of the two kilns, and they indicated that

[10] O. Mülhaueser, "Determination of Thermal Condition of Zinc Furnaces," *Metall u. Erz*, **8** (New Series) [6] 137–50 (March 22, 1920).

[11] F. Wesemann, "The Phenomena of Semi-Gas Firing," *Wärme*, **57** [40] 637–42 (Oct. 6, 1934).

[12] The data of these tests were published by (*a*) R. A. Sherman, R. F. Lunger, and W. E. Rice, "Combustion in Kilns Firing Refractory Ware," *Jour. Amer. Ceram. Soc.*, **7** [4] 255–70 (1924); (*b*) G. A. Bole, John Blizard, W. E. Rice, E. P. Ogden, and R. A. Sherman, "Problems in Firing of Refractories," *U. S. Bur. Mines Bull.*, No. 271, 197 pp. (1927).

long flames that could be seen in the kilns might be only burning particles of carbon formed by the cracking of hydrocarbons in or near the furnaces.

The analyses showed that combustion was more likely to be delayed in kiln 4 than in kiln 7. The reason for this is found in the design of the furnaces of the two kilns. In kiln 4, the arch of the firing opening was far enough above the horizontal grates that some control of secondary air was possible, whereas in kiln 7, the dead-bottom furnace was under a low arch formed by the thick wall of the kiln, and this forced the immediate mixing of the secondary air with the gases. Figure 3 shows the latter furnace and indicates the improbability of stratification of air and gases beyond the upper arch; although by tight firing it would be possible to obtain a high content of combustible in the gases within the bag wall, yet there could not be a parallel stream of air within the same bag wall.

If not enough air is admitted at the furnaces to burn the combustible gases, they either burn when they come in contact with enough air to complete combustion or they are lost through the stack if they do not meet enough air in a place where the temperature is high enough to ignite them. They can be burned in the kiln with air admitted through other furnaces.[13] In a kiln in which radial flues extended across the kiln and had thin removable brick doors at the ends to facilitate cleaning, when not enough air was admitted at the furnaces to burn the gases, air that leaked into the flues mixed with the gases and caused them to burn there with disastrous results to the flues.[14] In a kiln firing magnesite brick to a high temperature, flame was observed at the top of the stack; the luminosity of the flame that was observed probably was caused by particles of carbon, but analyses and measurements of temperature showed that for a short time after firing fresh coal not enough air to burn all the combustible gases had been admitted when they entered the stack and the temperature was high enough to ignite them.[15]

The data given in *Bulletin*, No. 271, are believed to represent fairly the conditions in most hand-fired downdraft kilns, but there is no assurance that all the samples in any series were taken from the same stream of gas; rather, it appears that they were not, because additional oxygen found in any sample collected beyond position "1" could come only from other streams. Efforts to obtain long flames by means of increased depth of fuel beds in these furnaces apparently defeated themselves. Although the coal was fired to fill the firing openings, yet the resistance here was still so much less than that through the fuel beds that the greater part of the combustion probably

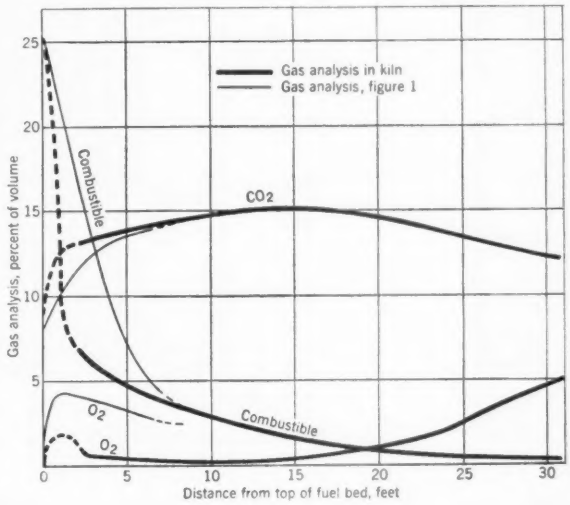

FIG. 4.—Process of combustion over the fuel bed in a kiln compared to data of Fig. 1.

was with air that entered through the firing openings, swept over the surfaces of the beds, and gave the same result that would be obtained in a thin fuel bed, that is, gases that contained much carbon dioxide, some oxygen, and little combustible.

Figure 4 shows what occurred beyond the top of the fuel bed in one instance (kiln 4, second test, 42 hours, immediately after firing). The light lines show the data of Fig. 1 reduced to the same scale. This plot shows that combustion beyond the fuel bed was more rapid in the kiln than in the experimental furnace but that $8\frac{1}{2}$ feet away from the fuel beds burning had been completed approximately to the same degree in both. Most of the analyses of sets of gas samples from the kilns show that combustion was completed even closer to the fuel beds than in this example. Further, study of all the data of the tests in the kilns indicates that at times the current of air that entered through the firing opening was so strong that what combustible gases were leaving the fuel bed were forced toward the bag wall, so that the gas sampling tube, which was placed in

[13] *Bur. Mines Bull.*, No. 271, p. 61 (see footnote 12).
[14] *Ibid.*, pp. 40 and 41.
[15] *Ibid.*, p. 24.

the center of the space above the fuel bed, was in a stream that contained more than the average amount of oxygen. At other times, when the air entered less forcibly at the firing opening, the stream at this position contained less than the average amount of oxygen.

The descriptive conclusions given in *Bulletin*, No. 271, may be summarized as follows:

(1) The usual designs of furnaces used in downdraft kilns are favorable to rapid mixing and combustion of the gases rising from the fuel bed and allow only slight opportunity for stratification of the streams of air and gas.

(2) The desirable principle for parallel streams of air and gas would be to prevent the entrance of secondary air immediately above the fuel bed and to admit it through holes some distance above. This is not practicable with natural draft because the plane of zero pressure in the kiln is, on the average, too low; it is more feasible as the furnaces are lowered relative to the floor.

(3) Secondary air under pressure could be blown into the kiln at any height desired.

(4) With natural draft, the alternatives suggested are as follows: (*a*) Alternate firing of furnaces so that the stream from one may contain combustible while that from the adjacent one has excess oxygen. (*b*) Secondary air can be admitted through vertical flues in the outer walls or bag walls, the entrance to these flues being low and the air being heated as it passes upward through the flues, thus creating the difference of pressure necessary to move it. (*c*) Secondary air could be admitted through ports in the walls of the kiln, placed low, and the inner ends surrounded by bag walls. This is essentially the same as the placing of vertical flues for secondary air in the outer walls between the furnaces, except that the air will be heated to a higher temperature in the supplementary bag walls.

The efficacy of any of the methods in delaying combustion during the travel of the gases through the setting has not been discussed. One would expect that the combustion of a mixture of gases containing combustible and free oxygen would be completed when such a stream enters a single channel; a longer delay would necessitate the mixing of different streams in their course through the setting.

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CONTROL OF COLORATION OF CLAYWARE IN THE TUNNEL KILN*

By W. D. Richardson

Abstract

In firing some clay products, control of kiln atmosphere and the character of the gases affecting coloration is as important as control of temperature.

Fuel gases should be kept from contact with ware in the watersmoking zone to insure against scumming and sulfuring. To control the character of the gases in the firing zone, whether oxidizing or reducing, air from the cooling zone should not pass into the firing zone except through the furnaces, the quantity of air admitted to each furnace being easily regulated. Such control is positively and practically accomplished in the progressing-compartment, downdraft tunnel kiln, which also can be adapted for salt glazing, the glazing compartment being operated independently during the salting.

I. Introduction

In firing some clay products, control of kiln atmosphere is nearly as important as the control of temperature, since it is the gases that largely regulate the color of the ware or produce undesired discolorations.

To obtain positive control of coloration, the tunnel kiln should have certain special, distinctive features, which it is the purpose of this paper to emphasize.

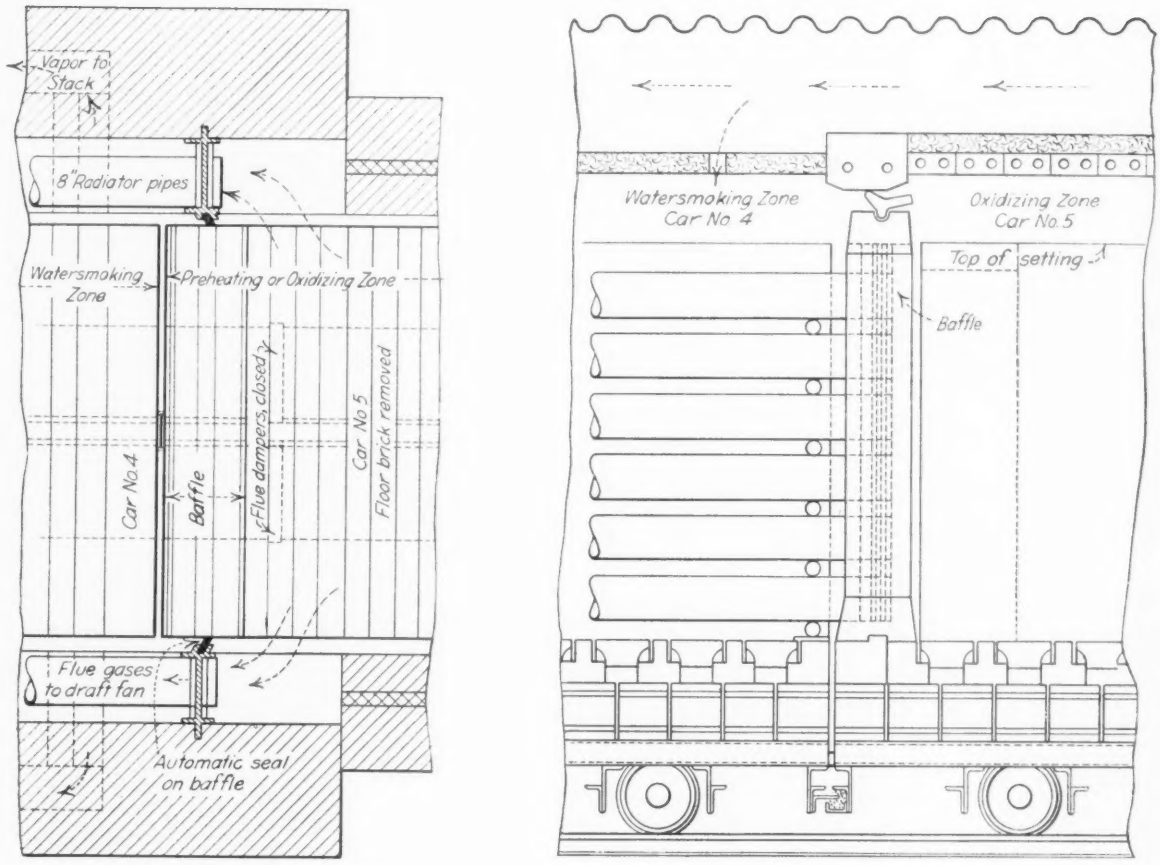
* Presented at the Annual Meeting, American Ceramic Society, Columbus, Ohio, March 30, 1936 (Ceramic Ware Firing Symposium). Received February 19, 1936.

II. Scumming

First, in the tunnel kiln, as in any continuous kiln, special provision must be made to prevent scumming or sulfuring during the watersmoking.[1]

In tunnel kiln operations there are two ways to watersmoke ware successfully: (1) The ware may be set directly from the press on kiln cars and dried and watersmoked in a separate tunnel, hot air being blown among the ware from the cooling zone or from a recuperator or auxiliary heater, and the hot cars successively transferred

[1] Removal of the hygroscopic water, not including the combined water.



PLAN SHOWING SEPARATION OF WATERSMOKING AND OXIDIZING ZONES

SECTION SHOWING BAFFLE PARTITION BETWEEN WATERSMOKING AND OXIDIZING ZONES

FIG. 1.

into the receiving end of the tunnel kiln. (2) The drying and the watersmoking may be done in a separate compartment of the tunnel kiln. The fuel gases can not enter this compartment but are conducted through the watersmoking zone in iron radiator pipes. In this case, air from the cooling zone or air heated by radiation of the arch over the firing zone, or both, is distributed throughout the watersmoking zone without sucking in fuel gases from the preheating zone.

The first method is practical with ware that can be set on the kiln cars without preliminary drying, such as dry-pressed brick, semidry-pressed and stiff-plastic products, and in some cases stiff-mud brick. Wherever this is practical, it offers a decided advantage in that it saves one handling and conserves the heat absorbed and stored in the car and ware during the drying. With some clays and some products, however, the losses in damaged ware may more than counterbalance the saving.

In many cases the most practical method for stiff-mud and plastic-molded ware is to dry them thoroughly before setting on kiln cars. In this method, the ware is cold or at the temperature of the kiln room when it enters the kiln, and water, condensed on the surface and in the presence of fuel gases, forms sulfuric acid which acts upon the carbonates in the clay, generally calcium carbonate. This converts them into soluble sulfates that on evaporation of the water are deposited on the ware and at higher temperatures produce the insoluble scum that is so objectionable. This scum may be "fired in" at sintering temperatures, but the ware loses its clear color. In a good tunnel kiln, however, there is not much danger of deformation in clays having a narrow vitrification range.

The prevention of scumming by the second

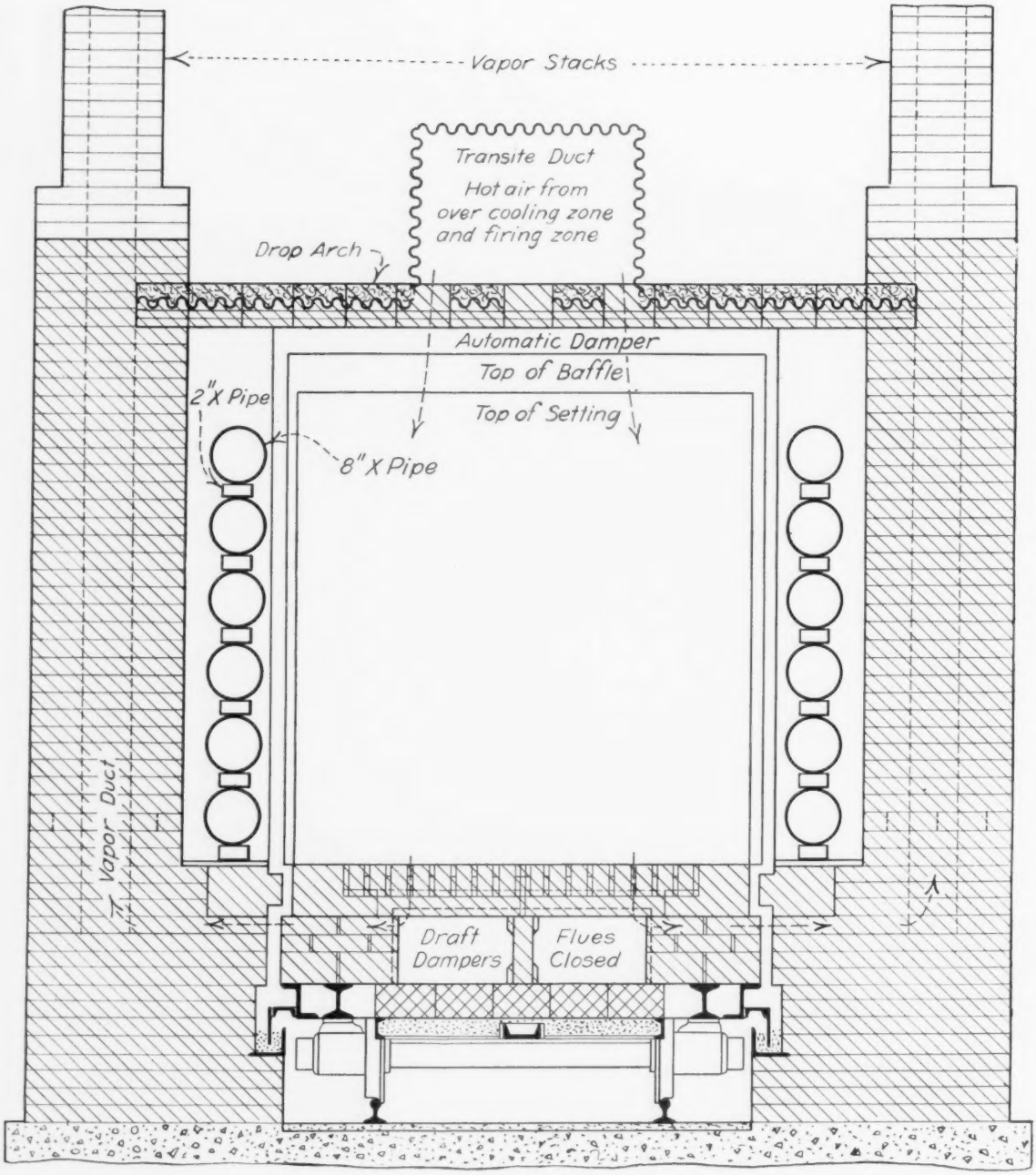


FIG. 2.—Sectional view of watersmoking zone.

method can be positively accomplished only in the downdraft, progressing-compartment tunnel kiln, in which the partition between the watersmoking and the oxidation zone is practically sealed, as shown in Figs. 1 and 2.

III. Development of Color

To get clear, solid colors without any flashing, such as pure red or clear manganese grays, the tunnel kiln must be so constructed that the atmosphere in the firing zone can be easily controlled and reducing gases practically eliminated. To produce the often-desired colors of the lower oxides, the atmosphere in the firing zone must be under such control that any flashed, reduction colors can be produced at will.

These requirements, as well as colors obtained by mineral vapors and salt glazing, can be met

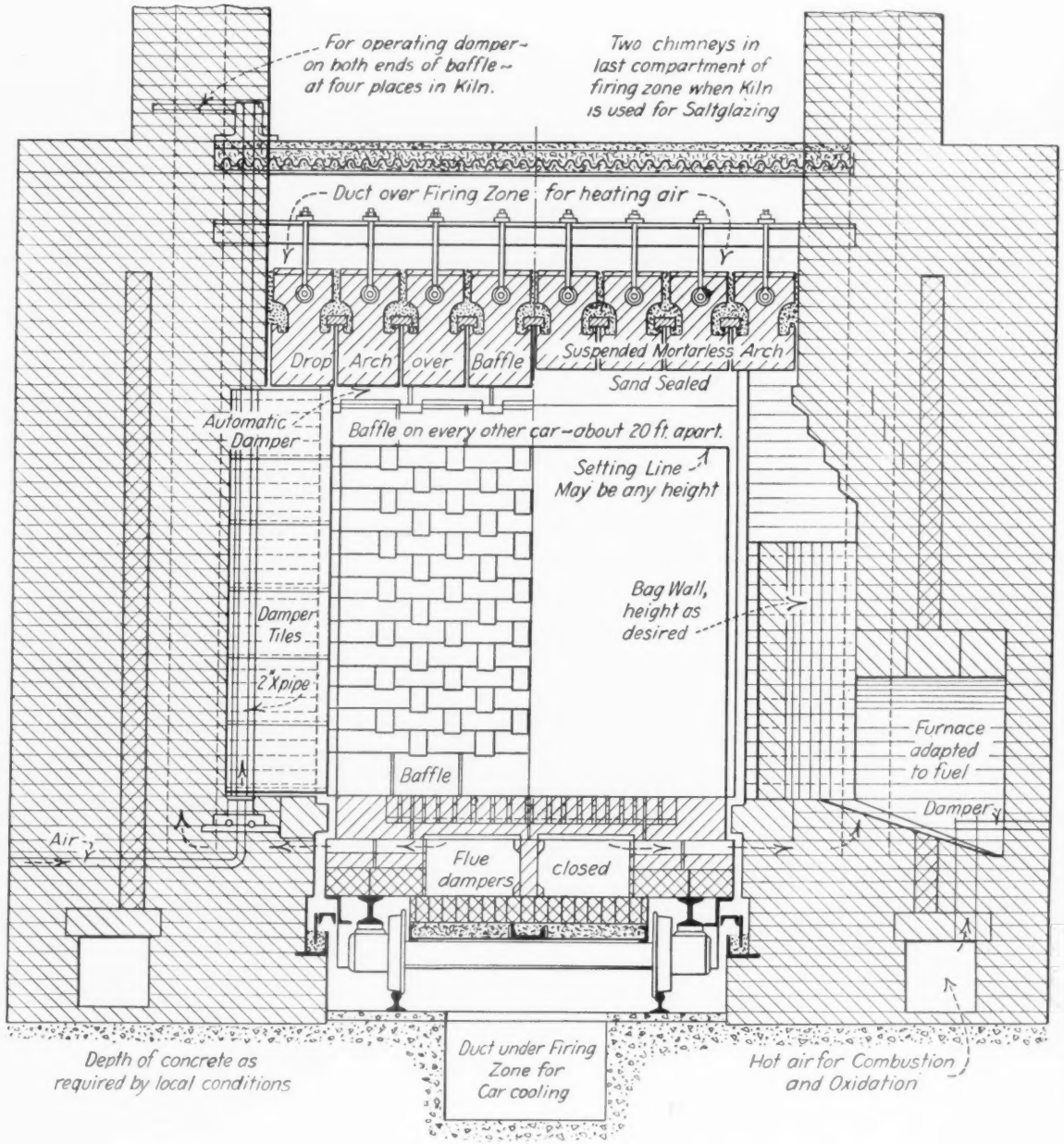

For operating damper on both ends of baffle at four places in Kiln.
Two chimneys in last compartment of firing zone when Kiln is used for Saltglazing
Duct over Firing Zone for heating air
Drop Arch over Baffle
Suspended Mortarless Arch Sand Sealed
Automatic Damper
Baffle on every other car—about 20 ft. apart.
Setting Line May be any height
Bag Wall, height as desired
Damper Tiles
2" X pipe
Baffle
Furnace adapted to fuel
Damper
Air
Flue dampers closed
Depth of concrete as required by local conditions
Duct under Firing Zone for Car cooling
Hot air for Combustion and Oxidation

FIG. 3.

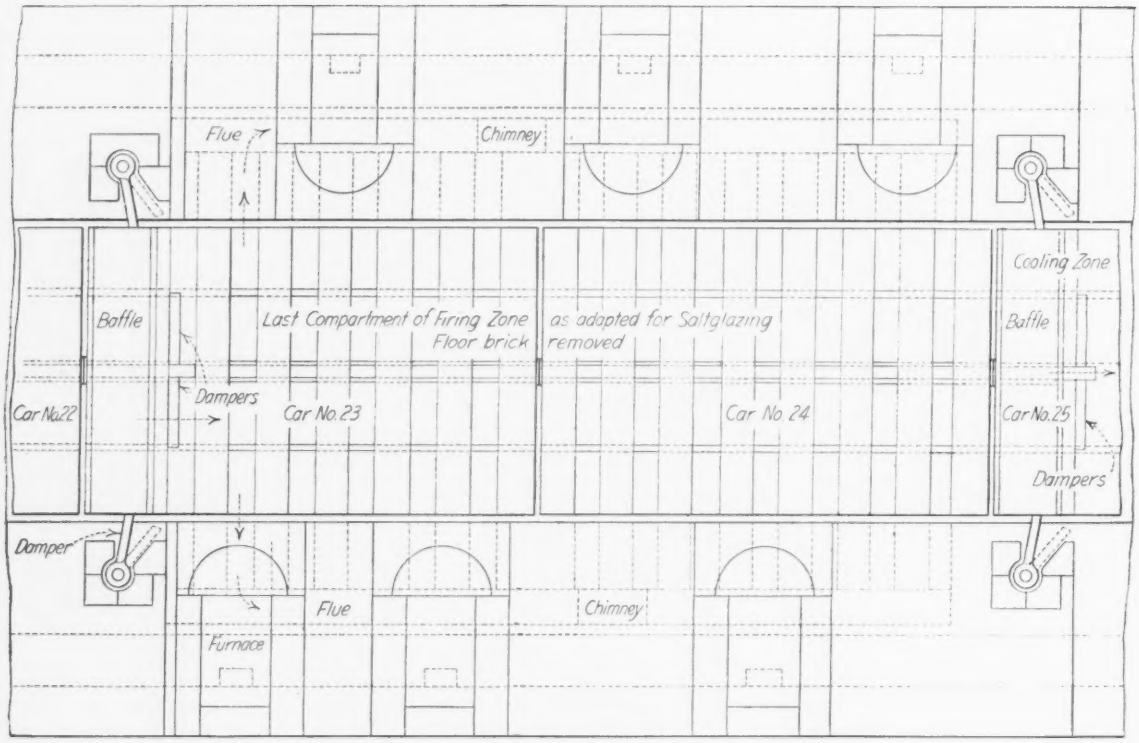


FIG. 4.—Plan.

positively and successfully only by the downdraft, progressing-compartment tunnel kiln, in which the compartment under maximum heat (the last compartment of the firing zone) is entirely shut off from the cooling zone. The hot air from the cooling zone is admitted to the firing zone only through the furnaces, and the quantity of air at each furnace is regulated by dampers or valves. When the kiln is used for salt glazing, both ends of the last compartment during salting are shut off and sealed from the cooling zone and from the other compartments of the firing zone, and the compartment is operated independently, without interfering with the operation of the rest of the kiln, as shown in Figs. 3 and 4.

The general features of the downdraft, progressing-compartment tunnel kiln have been described in an earlier paper.[2] The latest improvements have been made in the suspended arch, sand-sealed and mortarless, each unit automatically adjusting for expansion and contraction, and in a car with a lower platform, the steel frame being better insulated and more effectively sealed from the running gear. The downdraft, progressing-compartment tunnel kiln has been tried out and the defects have been corrected, making it the most practical, efficient, and economical kiln for brick and other structural clay products, including hollow building, paving, roofing, and drain tile and sewer pipe.

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COLUMBUS, OHIO

[2] W. D. Richardson, "Application of the Downdraft Principle to Tunnel Kilns," *Jour. Amer. Ceram. Soc.*, **14** [8] 572–77 (1931).

FACTORY EXPERIENCES IN DE-AIRING*

By T. W. Garve

Abstract

A compilation and classification of de-airing data obtained from seventy-five plants, most of them making structural clayware, is presented with some deductions.

I. Introduction

Nearly 175 de-airing machines are now in operation and, in reply to a questionnaire, data were received from seventy-five companies operating this equipment.

II. Water of Plasticity

Approximately 40% of the seventy-five plants did not know the amount of water they were using. Where the amounts were stated, they fell within the customary limits, chiefly below 20%, with some at 20% and two above that percentage. Only a few companies made a comparison between the amounts of water used with and without de-airing. Of the latter, we have the following expressions: "normal," "more for de-airing," "more water can be used," and "at least twice as much."

Two plants stated that close control of water is necessary.

* Presented at the Annual Meeting, American Ceramic Society, Columbus, Ohio, March 31, 1936 (Structural Clay Products Division). Received March 12, 1936.

III. Vacuum

Vacuum is expressed in inches of mercury. At sea level, a column of mercury in a vacuum tube will stand 30 (29.9) inches high so that a reading of about 30, if it can be obtained, would mean practically a true vacuum. A vacuum of 29 was stated seven times and this seems to be the practical limit. One tile and brick plant stated 29 to 29.6 inches. The pressure of the atmosphere decreases 0.12 inch for each additional 100 feet above sea level within our altitudes. Most clay plants of the East and Middle West and west of the Rockies, using local clays or shales, are located on elevations between 100 and 900 feet (most of them are closer to the lower figure), so that, except for the few higher altitudes, not over one inch needs to be added for the vacuum stated. Since it was impossible to obtain all the plant elevations, no corrections were made.

The following claims were made for the best vacuum:

Type of plant	Vacuum (in.)	No. of plants (%)
(1) Paving brick	26–28	13 (76)
	25	2 (12)
	22	1 (6)
	20	1 (6)
(2) Common brick	27	7 (45)
	25	4 (27)
	22	2 (14)
	20	1 (7)
	18	1 (7)
(3) Face brick*	28–29	3 (24)
	26–27	2 (17)
	22	1 (8)
	17–19	2 (17)
	15	2 (17)
	6–8	2 (17)

Type of plant	Vacuum (in.)	No. of plants
(4) Cellular brick	28	1
	26	1
(5) Hollow tile and brick (combined)	27–29	6
	25–26	4
	22	2
	15	1
(6) Hollow tile	29	1**
	26–27½	4
	24–25	2
	22	1
(7) Hollow and drain tile (combined)	25–27	3
	20–24	2
	15–17	1
(8) Sewer pipe and drain tile	26–28½	4
(9) Red flowerpots	28	1
(10) Stoneware	25	1
(11) Chemical stoneware†	27	1
(12) Fire brick (stiff-mud)‡	27–29	1

* The comparatively larger number of plants in the lower vacuum range on face brick should be noted; 2 brick plants emphasized the advantage of low vacuum, one to avoid excessive hardness and the other to avoid excessive weight and additional care in drying and firing.

** Eastern shale; more loss in drying and firing; more time in cooling.

† One foreign chemical stoneware plant recorded 95% which is 28.5 in.

‡ With increased drying problems.

IV. Die Changes (or Machine)

Sixty per cent of all plants recorded *no* changes.

Forty per cent recorded changes or adjustments. Among the changes stated, the following were named: shorter and *less* taper (2 paving brick), shorter and *more* taper (1 paving brick), shorter (1 brick and 1 brick and tile), longer (1 hollow tile), and very slight changes (5 miscellaneous plants).

Several plants were contemplating changes; some had made changes without specifying them; others stated "slight changes." One plant says that "it is a long story." It can be readily understood that many plants were not in a position to state in a few sentences the experiences they have gone through in die work and die balancing. A special investigation by machinery manufacturers is in place. The following comments are therefore but a few chapters of the story.

One brick plant changed a convex die (outlet) to a straight die because no more swelling of the long bar (from machine to cutter) was encountered with de-airing. A paving-brick plant made the surfaces concave back of the outlet to increase the density at the center of the clay column. A brick plant with a nonplastic shale needed better oiling, while another shale plant eliminated the lubrication owing to the improved workability and plasticity. Five hollow-tile plants claimed slower production, one of which pointed to auger changes. One plant making hollow and solid ware had to use baffles to balance the die pressure. One plant claims that the die must be balanced in front instead of in the rear by attaching steel plates to hold back the center of the column.

NOTE: Of the plants using shale, about twice as many were found in the 60% class recording *no* change, while the clay (surface and fire) plants were about evenly divided between the unaffected (60%) and affected (40%) plants. Perhaps the shales would have a still better showing if it were not for the high vacuum the paving-brick plants (using shale) are carrying.

V. Drying

Thirty per cent of the plants recorded *no* effect on time and no loss.

Seventy per cent recorded *some* effect, either favorably or unfavorably.

(1) *Affected favorably:* Less loss 14 plants (27%), less time 3 plants (6%), and improved 2 plants (4%); a total of 37% of the plants affected.

(2) (*a*) *Affected unfavorably:* More time 12 plants (23%), more loss 3 plants (6%), and more time and more loss 2 plants (4%).

(*b*) *Miscellaneous:* More care on hollow tile over drain tile; more care on fire clay over shale; loss offset by nonplastics; closer control (more care; less heat, etc.) 8 plants (17%), making a total of 50% of the plants affected unfavorably.

(3) *Affected both ways:* Less loss and less time, 7 plants (13%) of those affected.

To obtain perhaps a better picture, the unaffected and the favorably affected plants may be added as follows:

65% of all plants are *not* affected and are *favorably* affected.
32% are unfavorably affected.
3% are affected both ways.

A shale-brick plant recorded more time and more loss on small tile but less loss on large tile. One brick and tile plant with surface clay recorded more time with "considerably" more loss. One paving-brick plant with shale recorded the same time with "greatly reduced" loss.

(The note added to Die Changes (Section IV), in favor of shales, also applies to drying.)

VI. Firing

Forty per cent of all plants recorded *no* effect on time and no loss.

Sixty per cent recorded *some* effect, favorably or unfavorably.

(*1*) *Affected favorably:* Less loss 22% of the affected plants, lower temperature 10%, less time and less loss 5%, less time 5%, or a total of 42%.

(*2*) *Affected unfavorably:* More time 43% of the affected plants, more time and more loss 5%, more loss 2.5%, and higher temperature 2.5%, a total of 53%.

(*3*) *Affected both ways:* More time and less loss 2.5% of the affected plants, and lower temperature and more time 2.5%, a total of 5%.

Again the unaffected and favorably affected plants are added with these results:

65% of all plants are *not* affected and are *favorably* affected.
32% are unfavorably affected.
3% are affected both ways

It is interesting to note (in the totals, not individually) the complete analogy in drying and firing.

Questionnaire Quotations

(1) No change in time; great reduction in kiln loss (pavers, Waverly shales).

(2) 12 hours more time; slight loss reduction (pavers, Cleveland Chagrin shales).
(3) More time to avoid black coring on brick (short mix of clays and shale).
(4) 20% more time for oxidation if high vacuum; less loss (brick from shale of low plasticity).
(5) 24 more hours; more loss on cored brick only (brick from Indiana shale).
(6) Lower temperature with cellular brick (short mixture of shale and clay).
(7) 80°F lower temperature with 5% time increase (brick from very hard shale).
(8) Slower on shale and still slower on fire clay (brick and pavers from mixture of shales and fire clay).
(9) To be well watersmoked before raising heat (hollow tile from plastic clay).
(10) No change in continuous kiln; more oxidation time in round kiln (brick and tile from hard clay).
(11) 50% more watersmoking time to avoid spalling of large tile (brick and tile from clay).
(12) Maturing time 2 to 3 cones lower (brick and tile from mixture of clay and shale).
(13) More oxidation time, less vitrification time (brick and tile from short fire clay).
(14) High vacuum increases time in carbon range 24 hours (brick from Utica-Lorain shale).

The note added to Die Changes (Section IV), and applicable to drying (in favor of shale), also applies to firing.

VII. Cooling

For cooling, 46% of all plants recorded nothing and 32% *no* effect, or 78% favorable; 16% recorded more time and 6% more care, or 22% unfavorable.

Questionnaire Quotations

(1) Slightly slower to prevent air checking at quartz inversion at 1100°F; loss reduced from 5 to 1% (triassic shale with some clay and sand for pavers, brick, sewer brick).
(2) 5% more time (nonplastic shale for cored and uncored brick).
(3) Two more days (red shale for hollow tile).
(4) To be more careful between 1200° and 600° (mixture of shales and clay for a variety of hollow ware).
(5) More time ((*a*) plastic shale for pavers, (*b*) surface clay with shale for red flowerpots, and (*c*) mixture of clays for brick and tile).
(6) 20% more time (short knobstone with plastic shale for pavers and brick).
(7) 12 to 18 hours' more time to prevent glassy fracture in cooling and to produce more uniform firing (knobstone-carboniferous for pavers).
(8) Little more careful to avoid checking (blue Devonian shale for brick and tile).

VIII. Products

Improved or much better products were reported by 90% of all plants. This refers to density, strength, lamination, absorption, and appearance.

(1) Favorable Comments

Four hollow-tile plants and three brick (cored) plants would not be able to make ware without de-airing.

One paving-brick plant reduced off-grade ware from 25 to 10%.

Elimination of pinholes and blisters in stoneware was noted.

(2) Unfavorable Comments

One tile plant had to discontinue making tile because it was too "brittle."

One plant making brick and pavers from shale claims that it is difficult to make satisfactory rough texture and that the ware is much heavier.

Two face-brick plants record trouble in matching texture of nonde-aired brick.

IX. Business

In regard to widening of the market or increase of business, 20% of all plants gave no reply; 53% recorded an increase and 28% recorded *no* increase; regarding the last, "about the same, since all plants now have it"; "no, since all plants in our state are using it."

Several admit the difficulty of making a definite statement owing to the prevailing abnormal business conditions.

X. Other Characteristics

Certain outstanding characteristics, not covered or only partly covered by the previous points, are submitted below without reference to material or ware.

(1) Better handling of ware from machine and in setting.
(2) Harder and denser column at machine with less damage in handling.
(3) Increased ease and speed of handling ware from belt to cars.
(4) Fewer losses from die to kiln.
(5) Allows the use of less plastic clay with good results.
(6) In position to make good ware with clay which can not be used otherwise.
(7) A brittle shale which can not be handled at the machine without damage; if de-aired, can be handled with ease since firm.
(8) Impractical clay can be made fully satisfactory for shapes.
(9) Enabled to make cellular brick.
(10) Eight-inch vacuum has overcome lamination in brick.
(11) One hundred per cent better pipe; eliminated wet pan, saving $3000 per year in power.

Less favorable comments were as follows:

(1) Shale to be screened finer to keep down drier loss.
(2) Ware must not be flashed during oxidation or soaking period.
(3) Difficult to get texture on face brick, even coarser grinding not fully overcoming trouble.
(4) Greater care in machining, drying, and firing.
(5) Objection of masons.
(6) Moisture content and uniformity for size and hardness to be maintained to avoid trouble on flowerpot press.

(7) Well-known manufacturer does not get chipping because the 9-ft. pug mill is entirely under vacuum (chipping due to uneven removal of air).
(8) Solved many manufacturing troubles but increased auger and die troubles; recommends suitable machine design for each material.

For "dry-press fire brick," one plant uses a plastic fire clay with 50 to 70% grog, 10 to 12% water, 28-inch vacuum, requiring larger press equipment to take care of increased shrinkage; they have somewhat denser brick and shapes with greatly reduced laminations; drier and kiln losses are slightly reduced, but the principal advantage lies in better working qualities at the machine.

XI. Discussion of Foregoing Data

This paper represents a compilation of data received from many sources and does not try to find an answer to the many problems or to account for inconsistencies. While the clarification of the picture must be left to later developments and to individual research, there are a number of pertinent points which require emphasis or some explanation at this time.

The wet strength of clay, brought out by the first four or five comments under Other Characteristics (Section X) points again to the fact, emphasized by Lovejoy and other research workers,[1] that the beneficial effect on the wet strength of a clay is more pronounced than anything else. Many laboratory tests have shown that the 1-inch bar, if subjected to bending, will break open at a certain angle with the nonde-aired clay but, de-aired, will often permit coiling of the bar like a rope without breaking open. Similar tests by machinery companies on regular bars brought analogous results.

This investigation has brought out the fact that shales are affected to a lesser degree than clays. It is likely that this may be traced to the circumstance that clays have been in closer association with moisture and are more open and more finely divided, thus containing much occluded air, while shales, hardened under heat and pressure, possess less grain surface, have lost colloidal characteristics, and do not carry the amount of occluded or adsorbed air present in clays. It is chiefly this occluded air,[1] and to lesser degree the entrapped air, which is to be removed by de-airing to obtain marked results.

In reference to the statement under Section X that wet-pan preparation was eliminated in sewer-pipe manufacture (saving $3000 per year for power), the consequences for generalization must be emphasized. Lovejoy[2] says, "We hold that passing the wet clay under the pan mullers squeezes out more or less of the occluded air and to this is due the gain in the ware." If de-airing can do the work of a wet pan or wet pans, it will make itself conspicuous in pipe plants or other plants using wet-pan preparation.

In reference to firing, de-aired ware, being much denser and tending to brittleness at high temperature, should be fired to a lower temperature (less time and fuel) to avoid glassiness or brittleness. If some plants are taking this measure, perhaps others can.

In reference to vacuum, it is interesting to note that a low vacuum (as low as 6) in several cases has had sufficient beneficial effect on solid brick without introducing the disadvantages in the drier and kiln and an overdense product. If some plants have found such low vacuum beneficial, other plants seem to be justified in adapting it or trying it.

In reference to a relationship of the effects in machine, drier, and kiln and especially between die and drier, we have arranged the following table, based on 63 plants; it refers to "unfavorable" effects only, and a few minor or slight changes have been included with the *no's* in the table.

Plants (%)	Die changes	Drier effect	Firing effect
44	No	No	No
or			
47	No	No	
22	Yes	Yes	Yes
or			
23	Yes	Yes	
11	No	Yes	
19	Yes	No	

We see that 66% of all plants carried the effect or noneffect through from die to firing and 70% from die to drying. This is quite notable but readily understood if we consider that after de-airing we are dealing with a new clay. We also see that 11% with *no* die changes recorded drying

[1] For a bibliography on de-airing, see list of papers accompanying the paper by D. F. Stevens and R. P. Stevens, "De-Airing of Floor Tile," *Bull. Amer. Ceram. Soc.*, **14** [9] 291–93 (1935).

[2] Ellis Lovejoy, Fundamentals and Economies in the Clay Industries. Randall Publishing Co., Wellsville, N. Y., 1935. ii + 361 pp. Price $4.00. Reviewed in *Ceram. Abs.*, **14** [9] 236 (1935).

effects, while 19% *with* die changes recorded *no* drying effects.

Leaving out the 70% pronounced cases and considering the last two items we see that, while 11% with no die changes recorded drying effects (unfavorable), nearly twice as many plants (19%) which had made die changes recorded no drying effects. This seems to indicate quite strongly the beneficial effect of the die change or die balancing upon drying. In other words, perhaps one-half of the drier troubles might be attributed to the die.

XII. Problems to Be Considered

There are numerous problems left to discussion or research waiting for solution, among which are the following:

(1) Is the air simply entrapped or occluded or both? If it were only entrapped air, subsequently working the clay in the atmosphere should be harmful but benefits of such double operation are reported. On the other hand, Straight[3] has shown with his pug-mill knives that entrapped air surely has something to do with it.

(2) The elimination of the wet pan supports the claim made by some authorities that attrition in wet-pan grinding eliminates some of the occluded air or gas. The wedging or rolling table, the wet pan, Straight's muller disk, etc., have been presented as more or less effective. To what extent can we eliminate occluded air (gas) by such treatment?

(3) Blisters on structural ware have been attributed to entrapped air. May they not be largely due to occluded air? Blisters are superficial and, if due to entrapped air, we would expect to find deep-seated blisters since deep-seated clay is subjected to lamination and will contain a full measure of entrapped air. Even though we appreciate the fact that resistance to expansion increases with depth, blisters would not be exclusively superficial if entirely due to entrapped air.

One manufacturer lessened the blistered ware by de-airing. He did not fully overcome this defect although he uses a high vacuum, shreds the clay, and gives ample time. May not this be a case of high adsorptive power?

(4) Clays probably differ widely in the volume of occluded air or gas, and an investigation of this may give us an answer to the widely varying behavior of clays as to lamination, blisters, etc. One reliable authority reported an air content of 140%, and we may accept this since we know that the adsorptive power of some minerals greatly exceeds this. There could not be such wide difference in entrapped air.

(5) Do clays differ in their adsorptive power, in the tenacity or affinity between clay and gas molecules? How else can we explain results from such low pressures as 6 or 8 inches vacuum? It is said, however, that as high as 28 inches is essential to eliminate the air. This is true with some clays but not with others, and why?

(6) Several respondents to the questionnaire stated that de-aired clay required more water to get equivalent workability. One respondent stated that if the vacuum pump is stopped. the bar immediately becomes too soft and will swell and buck. Presumably this would be true in all cases where more water is required for the de-aired clay.

Is it true that de-aired clayware, as it comes from the machine, contains more water than the ware from the clay not de-aired? This can easily be ascertained by determining the quantity of water per unit mass of these products.

If this is not true, then the reported excess water of plasticity would be required to restore the evaporation losses due to de-airing. It seems incredible that this alone will account for the excess water required for de-aired clay. We must assume, therefore, that in some instances de-aired clay requires more water in order to get the desired degree of mobility. If evaporation losses alone were the explanation of a greater water consumption, then all clays should require more, but this is not borne out by the replies to the questionnaire.

Before research has given a definite answer to the above, we may consider free air either as a lubricant or occluded air (gas) as such, or both. In the first case, the de-aired product will need more water to develop the slippage formerly due to the entrapped air. And in the second case, the de-aired product will need more water since formerly the air (gas) molecules attached to the molecular clay grains were aiding mobility. The varying water requirements may be due to variations in the amount of free air and occluded air (gas) in the different clays.

[3] H. R. Straight, "Streamlined Pugging Knives Keep Air Out of Clay," *Brick Clay Rec.*, **86** [1] 22 (1935); *Ceram. Abs.*, **14** [4] 97; [5] 121 (1935).

Perhaps certain inconsistencies (*e.g.*, water of plasticity, vacuum, etc.) in the answers to the questionnaire would be less pronounced or partly eliminated if fundamental conditions (especially as to thoroughness of grinding, screening, and pugging), dealing in every case more or less with unit grains, would have been identical in all the various plants.

Condensed Data of Percentages

Vacuum

76% paving-brick plants 26–28 in
72% common-brick plants 25–27 "
49% face-brick plants 24–29 "
34% " " " 15–19 " } note low vacuum
17% " " " 6– 8 " }
Hollow ware, pipe, red flowerpots, 24–29 in. (mainly upper limit)
Stoneware 25–27 in.

Die

60% of all plants, no change
40% " " " changes or adjustments

Drying

30% of all plants, no effect
70% " " " affected (loss of ware or drying time)
Unfavorably affected: 50% of affected plants (more loss, more time)
Favorably affected: 37% " " " (less loss, less time)
Affected both ways: 13% " " " (less loss, more time)

Adding together the nonaffected and favorably affected

65% of all plants not affected and favorably affected
32% " " " unfavorably affected
3% " " " affected both ways

Firing

40% of all plants, no effect
60% " " " affected (loss of ware or firing time)
Unfavorably affected: 53% of affected plants (more loss, more time)
Favorably affected: 42% " " " (less loss, less time)
Affected both ways: 5% " " " (less loss, more time)

Adding together the nonaffected and favorably affected

65% of all plants not affected and favorably affected
32% " " " unfavorably affected
3% " " " affected both ways
In other words, two-thirds of the plants were *not* detrimentally affected in drying and firing (note analogy in totals, not individually)

Cooling

46% of all plants, nothing } 78% favorable
32% " " " no effect }
16% " " " more time } 22% unfavorable
6% " " " more care }

Product

90% of all plants, a better or much better product

Business

19% no record
53% increase in business
28% no increase in business

The question of the effect of de-airing on power consumption has not been considered, principally because of the limitation of time and space. At the present time, it is generally accepted that the de-airing machine consumes approximately the same amount of power as the old-type machines. It is assumed that any saving of power due to improved working qualities is counteracted by that required to operate the vacuum pump. One plant, however, reported a saving of 25% in power after the installation of the de-airing equipment. It appears, therefore, that a study should be made of this phase of de-airing.

Acknowledgment

This paper is the outcome of a suggestion by A. F. Greaves-Walker to the writer (as Chairman of the Data Committee) to make a systematic investigation and, if possible, to clear up the confusion on de-airing data which seemed to prevail at the Annual Meeting of the Society in 1935.

235 West Tenth Avenue
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MEMBERSHIP ROSTER OF THE AMERICAN CERAMIC SOCIETY

The Membership Roster is being published for the use of members of the Society. The list is alphabetical; Corporation Members are in black-face type, the name of the voting representative following in parentheses; Charter, Life, Honorary, and Student Members are indicated after their respective names.

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Ball Brothers Co. (George A. Ball), Muncie, Ind.
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Rickmann, E., Rickmann & Rappe, G.m.b.H., Chemische Fabriken, Köln-Kalk, Germany.
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Rieke, Reinhold (Honorary), Royal Porcelain Factory, Berlin, Germany.
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Robertson, Randal K., 906 University Tower Bldg., Montreal, Quebec, Canada.
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Rodgers, Joseph P., Seaboard Feldspar Co., 4214 Connecticut Ave., Baltimore, Md.
Roehm, Victor J., Sebring Pottery Co., Sebring, Ohio.
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Rogers, Thomas S., Sears Roebuck & Co., Dept. 817, Chicago, Ill.
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Rossell, H. A., Christmas, Ariz.
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Trenton Potteries (James Hamilton), Box 141, Trenton, N. J.
Trevathan, P. Edward, Templeton, Pa.
Trostel, L. J., General Refractories Co., Box 1673, Baltimore, Md.
Troutman, Frank E., Standard Plate Glass Co., Butler, Pa.
Trowbridge, P. S., Hydraulic Press Brick Co., 1337 S. Kingshighway, St. Louis, Mo.
Troy, Walter J., 139 Melrose St., Rochester, N. Y.
Truman, Gail R., 305 East Main St., Brookville, Pa.
Tucker, Jesse L., Box 494, Newark, Ohio.
Turbett, Forrest L., Eagle Picher Lead Co., 1030 Broadway, Cincinnati, Ohio.
Türk, Karl, Porcelain Enamel & Manufacturing Co., Baltimore, Md.
Türk, Richard H., Porcelain Enamel & Manufacturing Co., Baltimore, Md.
Turnbull, Edward D., 500 Penn Ave., Scranton, Pa.
Turnbull, Gale, Vernon Potteries, Ltd., Vernon, Calif.
Turner, Arthur A., 25 Cliffwood Place, Metuchen, N. J.
Turner, Cecil H., 6728 Maple St., Mariemont, Ohio.
Turner, Donald, Messrs. Lodge Plugs, Ltd., Rugby, England.
Turner, W. E. S. (Honorary), The University, Darnall Rd., Sheffield, England.
Tuttle, George N., 56 N. Willowgrove Ave., Dayton, Ohio
Twells, Robert, 2142 Kenwood Blvd., Toledo, Ohio.
Twining, F. E., Twining Laboratories, Fresno, Calif.
Tyler, W. S., Co. (F. P. Nickerson), Cleveland, Ohio.
Tyler, George H., Box 250, Elyria, Ohio.
Tyrrell, Miles E. (Student), 201 Elm St., Rolla, Mo.

Uhrmann, Carl J., Jr., Overlook Court, R. R., Bellaire, Ohio.
Ulmer, Carl D., Koppers Construction Co., Research Division, 713 Koppers Bldg., Pittsburgh, Pa.
Umeda, Otogoro, 108 Minami 6-chome, Aoyama, Akaskaku, Tokyo, Japan.
Underwood, C. A., 61 Salisbury St., Winchester, Mass.
Union Française des Produits Refractaires, 15 Rue de Milan, Paris 9e, France.
United Clay Mines Corp. (K. E. Ward), Oakland & Prospect Sts., Trenton, N. J.
Universal Clay Products Co. (C. A. Bloor), Sandusky, Ohio.
Universal Dental Co. (Joseph Kohn), 48th & Brown Sts., Philadelphia, Pa.
Universal Sanitary Manufacturing Co. (W. Keith McAfee), New Castle, Pa.

Vachuska, E. J., 3518 Daisy Ave., Cleveland, Ohio.
Vail, James G., 121 S. 3rd Street, Philadelphia, Pa.
Vaksdal, Alfred, 55 Goff St., Corning, N. Y.
Valentine, Frank R., 150 Green St., Woodbridge, N. J.
Vance, E. D., Safety Grinding Wheel & Machine Co., Wheel & Larch Sts., Springfield, Ohio.
Van Cleave, A. A., 650 S. Highland Ave., Los Angeles Calif.
Vanderpool, James W. (Student), 17 Elmwood Ave., Dedham, Mass.
Van Gelderen, E. M., Enschede, Holland.
Van Hagan, H. H., Certain-Teed Products Corp., Military Rd., Buffalo, N. Y.
Van Nieuwenburg, C. J., Rotterdamschweg, Delft, Holland.
Van Schoick, E. H., Chicago Retort & Fire Brick Co., Ottawa, Ill.

Vaughan, W. H., Georgia School of Technology, Atlanta, Ga.
Verreries Souchon Neuvesel, Siege Social, a Lyon 8, 10 Rue de la Bourse, France.
Vesuvius Crucible Co. (Francis L. Arensberg), Box 29, Swissvale, Pa.
Vickers, Arthur E. J., Hazeldene, Junction Rd., Norton-on-Tees, Durham, England.
Vielhaber, Louis, Lippestr. 11, Duisburg, Germany.
Vieweg, Hermann, 323 Lawrence Ave., Highland Park, N. J.
Vincent, Harry S., Vincent Clay Products Co., Fort Dodge, Iowa.
Vinther, E. Heikel, Porcelainfabriken Norden, Valby Langgade 95, Copenhagen, Denmark.
Vitreous Steel Products Co. (Edgar H. Weil), Sta. D, Cleveland, Ohio.
Vitro Manufacturing Co. (E. M. Fleck), Corliss Sta., Pittsburgh, Pa.
Vodicka, Albert L., Aetna Porcelain Enameling o., 4701 Augusta St., Chicago, Ill.
Vollmer, August, Jr., St. Louis Pottery Co., 5240–5246 Northrup Ave., St. Louis, Mo.
Vollrath Company (J. C. Vollrath), Sheboygan, Wis.
Vollrath, A. J., 2123 N. 6th Street, Sheboygan, W
Vollrath, J. C., Vollrath Company, Sheboygan, Wis.
Voorhies, James A., 1001 Morrell Ave., Connelsville, Pa.
Voss, Walter C., Room 5-229, Massachusetts Institute of Technology, Cambridge, Mass.

Waggoner, Jack H., Owens-Illinois Glass Co., Muncie, Ind.
Waite, Virgil H., 316 Beech St., Berea, Ohio.
Wakymoto, Seichi, 200 Fifth Ave., New York, N. Y.
Walden, Albert S., National Carbon Co., Cleveland, Ohio.
Walker, E. E., Australian Tesselated Tile Co., Mitcham, Victoria, Australia.
Walker, Francis W., Jr., 105 W. Second St., Frederick, Md.
Walker, Prescott H., Carborundum Co., Niagara Falls, N. Y.
Wall, Gertrude R., 5506 Telegraph Ave., Oakland, Calif.
Walsh, Donald E., Consolidated Feldspar Corp., Kingman, Ariz.
Walters, Durwood B., 1407–1447 S. 55th Court, Cicero, Ill.
Waltham Grinding Wheel Co. (M. F. Cunningham), Waltham, Mass.
Walton, S. F., Exolon Co., Blasdell, N. Y.
Walworth, Chester A., Libbey-Owens-Ford Glass Co., Charleston, W. Va.
Wampler, Roy W., Libbey-Owens-Ford Glass Co., Oakdale & E. Broadway, Toledo, Ohio.
Wang, Harold E. M., Yao Hua Mechanical Glass Co., Chinwangtao, Hopei Province, North China.
Ward, Charles J., A. P. Green Co. of Canada, Ltd., 40 Hanna Ave., Toronto, Ontario, Canada.
Ward, Gilbert O., Cleveland Public Library, 325 Superior Ave., N. E., Cleveland, Ohio.
Ward, K. E., United Clay Mines Corp., Oakland & Prospect Sts., Trenton, N. J.
Warde, John M. (Student), Montana School of Mines, Butte, Mont.
Wardley, Thomas, Westpoint Rockware Ave., Greenford, Middlesex, England.
Wareham, John D., Rookwood Pottery Co., Mount Adams, Cincinnati, Ohio.
Warner, Stanley, 114 Mitchell Dr., Lookout Mountain, Tenn.
Warren, Bertram E., Massachusetts Institute of Technology, Cambridge, Mass.
Warrick, Earl L., 309 Ridgewood Ave., West View, Pittsburgh, Pa.
Wassman, L. G., Standard Sanitary Manufacturing Co., Richmond, Calif.
Watkin, Robert W., 566 Indiana Ave., Sebring, Ohio.
Watkins, Ray T., U. S. Tariff Commission, Ceramic Division, Washington, D. C.
Watkins, W. J., Kentucky Clay Mining Co., Mayfield, Ky.
Watson, William, Elgin Fireclays Ltd., Box 257, Springs, Transvaal, South Africa.
Watson, William A., Stowe-Fuller Refractories Co., 1717 Union Trust Bldg., Cleveland, Ohio.
Watt, Loren, Roseville, Ohio.
Watters, C. R., 773 S. Haine St., Alliance, Ohio.
Watts, Arthur S., Dept. of Ceramic Engineering, Ohio State University, Columbus, Ohio.
Wayne Laboratories (John J. Shank), 17 East Main St., Waynesboro, Pa.
Weaver, Arthur F., 11307 Hessler Rd., Cleveland, Ohio.
Weaver, R. A., Ferro Enamel Corp., 4150 E. 56th Street, Cleveland, Ohio.
Weber Electric Co. (August Weber, Jr.), Schenectady, N. Y.
Weber, August, Jr., Weber Electric Co., Schenectady, N. Y.
Weber, Harry W., 1469 Third Ave., New Brighton, Pa.
Webster, Charles E., 889 Minoma Ave., Louisville, Ky.
Wedemeyer, N. G., Rohm & Haas Co., 222 W. Washington Sq., Philadelphia, Pa.
Wehtje, Ernst, Postbox 129, Malmö, Sweden.
Wehtje, Karl Fredrik, A/B Rörstrands Porslinsfabriker, Lidköpings Porslinsfabrik, Lidköping, Sweden.
Weigel, William M., Missouri Pacific Bldg., St. Louis, Mo.
Weil, Edgar H., Vitreous Steel Products Co., Sta. D, Cleveland, Ohio.
Weimer, L. S., Malleable Iron Range Co., Beaver Dam, Wis.
Weinfurtner, E. M., North American Refractories Co., National City Bank Bldg., Cleveland, Ohio.
Weinheimer, C. M., Detroit Electric Furnace Co., 825 W. Elizabeth St., Detroit, Mich.
Weis, J. H., Oxford Mining & Milling Co., West Paris, Maine.
Weldon, Walter A., 621 Edgewood St., Baltimore, Md.
Wells, A. A., Homer Laughlin China Co., Newell, W. Va.
Wells, Joseph, Homer Laughlin China Co., Newell, W. Va.
Wenczel, Stephen, New Jersey Porcelain Co., Box 908, Trenton, N. J.
Wendt, J. P., Crown Potteries Co., Evansville, Ind.
Wenger, A. H. C., Messrs. Wengers Ltd., Etruria, Stoke-on-Trent, England.
Wenning, W. F., Ceramic Color & Chemical Mfg. Co., Box 297, New Brighton, Pa.
West, Frank, Haslemere Greenlane, Buxton, Derbyshire, England.
Westendick, Frank C., State of Florida, Geological Dept., Tallahassee, Fla.
Western Brick Co. (F. M. Butterworth), Danville, Ill.
Western Electric Co. (L. I. Shaw), Hawthorne Sta., Chicago, Ill.
Westfeldt, Martha G., 3120 Coliseum St., New Orleans, La.
Westinghouse Electric & Manufacturing Co. (E. H. Fritz), Derry, Pa.
Westman, A. E. R., Ontario Research Foundation, 47 Queen's Park, Toronto 5, Canada.
Weston, Ralph H., Schneider Brick & Tile Co., Slidell, La.
Westphalen, W. J., Laclede-Christy Clay Products Co., 1711 Ambassador Bldg., St. Louis, Mo.
Weyl, Woldemar, Department of Ceramics, Pennsylvania State College, State College, Pa.
Wheaton, Frank H., Millville, N. J.
Wheeler, D. D., 362 West 7th, Erie, Pa.
Wheeler, Herbert A. (Charter Life), 900 Security Bldg., St. Louis, Mo.
Wheeler, Thorne L., Arthur D. Little, Inc., 30 Charles River Rd., Cambridge, Mass.
Wheeling Steel Corp. (W. F. Copp), Portsmouth, Ohio.
Whipple, A. D., Box 643, Alexandria, Ind.
Whitaker, Fred A., General Ceramics Co., Keasbey, N. J.
Whitaker, H., Rustless Iron Co., Ltd., Trico Works, Keighley, England.
Whitall-Tatum Co. (George S. Bacon), Millville, N. J.
White, Harold E., 308 Beaver Rd., Zelienople, Pa.
White, Harold I., Box 617, Niagara Falls, N. Y.
White, Milo A., Jr., 311 E. Main St., Fremont, Mich.

White, R. H., Abrasive Co., Bridesburg, Philadelphia, Pa.
Whiteley, Joseph O., Dentists' Supply Co., York, Pa.
Whitesell, Robert J., 5023 Akron St., Philadelphia, Pa.
Whitford, W. G., School of Education, Box 20, University of Chicago, Chicago, Ill.
Whitlatch, George I., 401 Seventh Ave., N., Tennessee Division of Geology, Nashville, Tenn.
Whitmer, J. D., Sparta Ceramic Co., East Sparta, Ohio.
Whittemore, J. W., Virginia Polytechnic Institute, Blacksburg, Va.
Whittemore, O. J., Sheffield Brick & Tile Co., Sheffield, Iowa.
Wickerham, F. A., 719 Carnegie Bldg., Pittsburgh, Pa.
Widemann, R. V., 25 Boulevard Jules Sandeau, Paris, 16, France.
Wiedemann, H. E., 1604 Chemical Bldg., St. Louis, Mo.
Wigley, John T., 207 Maplehurst Ave., Syracuse, N. Y.
Wildblood, Norman R., Blythe Colour Works Ltd., Cresswell, Stoke-on-Trent, England.
Wilkes, Gordon B., Massachusetts Institute of Technology, Cambridge, Mass.
Willetts, H. G., 1990 Crafton Blvd., Crafton Sta., Pittsburgh, Pa.
Willetts, Paul G., Hartford Empire Co., Hartford, Conn.
Willey, Wade R., 36 Cutler, S. W., Grand Rapids, Mich.
Williams, Arthur E., 810 Columbia Terrace, Peoria, Ill.
Williams, Clyde E., 505 King Ave., Columbus, Ohio.
Williams, Francis J., Mellon Institute, Pittsburgh, Pa.
Williams, George F., 414 E. 3rd Street, Corning, N. Y.
Williams, Glenn D., 863 Amherst Place, Brentwood Heights Sta., Los Angeles, Calif.
Williams, John A., Box 250, Trenton, N. J.
Williams, Robert A., Jr., Franklin Tile Co., Lansdale, Pa.
Wills, George A., 77 Flower Ave., Takoma Park, Washington, D. C.
Willson, B. W., Route 1, Zillah, Wash.
Wilson, C. L., American Vitrified Products Co., Lisbon, Ohio.
Wilson, Earl O., Yenching University, Peiping, China.
Wilson, Hewitt, University of Washington, Seattle, Wash.
Wilson, Louis A., New Jersey Zinc Co., Testing Dept., Palmerton, Pa.
Wilson, Norman, Josiah Wedgwood & Sons, Ltd., Etruria, Stoke-on-Trent, England.
Winburn, H. L., Benton, Ark.
Winkelmann, F., Irish Glass Bottle Co., Ltd., Charlotte Quay, Dublin, Ireland.
Winship, William W., 58 Schenectady Ave., Brooklyn, N. Y.
Wiss, J. E., 1976 N. Fourth St., Columbus, Ohio.
Wiswall, C. L., E. I. du Pont de Nemours & Co., Inc., R. & H. Chemicals Dept., Wilmington, Del.
Witherow, Charles N., Berwindale, Clearfield County, Pa.
Witschey, R. A., Battelle Memorial Institute, 505 King Ave., Columbus, Ohio.
Wolff, C. H., Wheeling Steel Corp., Portsmouth, Ohio.
Wolfram, H. G., Porcelain Enamel & Manufacturing Co., Baltimore, Md.
Wong, Edwin, China General Edison Co., 140 Robison Rd., Shanghai, China.
Wong, On Yuen, 456 W. Yat Tak Rd., Canton, China.
Wong, Y. Y., 1 Prince Terrace, Hongkong, China.
Woodhouse, Charles D., Box 117, Laws, Inyo County, Calif.
Woodruff, Ernest W., 427 W. Erie St., Chicago, Ill.
Woods, William J., Box 627, Lewistown, Pa.
Worcester, W. G., Dept. of Ceramics, University of Saskatchewan, Saskatoon, Saskatchewan, Canada.
Wortley, G. W., R. & A. Main, Ltd., Falkirk, Scotland.
Wright, Daniel K., Incandescent Lamp Dept. of General Electric Co., Nela Park, Cleveland, Ohio.
Wright, Edward P., 313 W. 6th Street, East Liverpool, Ohio.
Wright, George C., 3467 Clearfield Ave., Pittsburgh, Pa.
Wright, J. W., 620 Union St., Alton, Ill.
Wright, M. H., Tennessee Enamel Manufacturing Co., Park Ave. & Railroad, W. Nashville, Tenn.
Wright, Thomas J., 40 Prince Arthur Ave., Toronto, Ontario, Canada.
Wurtsbaugh, C. G., 6801 Stafford Ave., Huntington Park, Calif.
Wyckoff, Wilbur R., 62 Doughty Ave., Somerville, N. J.
Wysor, D. C., General Chemical Co., 40 Rector St., New York, N. Y.

Yanovsky, Alexander, 92 Hoy Ave., Fords, N. J.
Yoder, C. P., Buffalo, Niagara & Eastern Power Corp., 504 Electric Bldg., Buffalo, N. Y.
Young, David A., 6135 Crescent, St. Louis, Mo.
Young, David H., Georgia Kaolin Co., Dry Branch, Ga.
Young, Mrs. George, Roseville Pottery Co., Zanesville, Ohio.
Young, J. H., E. I. du Pont de Nemours & Co., R. & H. Chemicals Dept., Perth Amboy, N. J.
Young, Vincent M., 18 Portsmouth Terrace, Rochester, N. Y.
Young, Willard G., 206 Jefferson St., Robinson, Ill.

Zapfe, Richard C., Pomona Tile Co., Pomona, Calif.
Zapp, Friedrich, "Porzellanverband," Karlsbad, Czechoslovakia.
Zeiller, Oscar F., B. F. Drakenfeld & Co., 45–47 Park Place, New York, N. Y.
Zimmer, Daniel B., 1381 Sedgwick Ave., New York, N. Y.
Zimmer, David C., Patterson Refractories Co., East Liverpool, Ohio.
Zimmer, Harry, Porzellanfabrik, Waldershof, Oberpfalz, Germany.
Zimmerman, K., Rijkskleischool, Lange Tiendeweg 79, Gouda, Holland.
Zoller, Miles M., Eagle Picher Lead Co., Temple Bar Bldg., Cincinnati, Ohio.
Zopfi, Albert S., 1143 River Rd., Maumee, Ohio.
Zvanut, Frank J. (Student), 109 E. 12th St., Rolla, Mo.
Zwermann, Carl H., Jr., Robinson, Ill.
Zwetsch, Artur, Hindenburgstr. 56, Ratingen (Rheinland), Germany.

ACTIVITIES OF THE SOCIETY

GLASS DIVISION PROGRAM

Hotel Riverside, Cambridge Springs, Pa., October 23 and 24, 1936

The formal program will consist of reports on several outstanding subjects by members of the Glass Division who were abroad during July and August.

Friday, October 23, Hotel Riverside

1:00 P.M.

(1)"A Few Pictures," by Francis C. Flint (*President, American Ceramic Society*), Hazel-Atlas Glass Co., Zanesville, Ohio.

(2)"Chemical Durability at Home and Abroad—A Résumé," by Donald Sharp, Bailey and Sharp Co., Hamburg, N. Y.

(3)"Standard Tests and Specifications for Glass—A Discussion of the National, Foreign, and International Aspects and Prospects," by S. R. Scholes N. Y. State College of Ceramics, Alfred, N. Y.

(4)"The European Glass Fiber Industry," by Games Slayter, Owens-Illinois Glass Co., Newark, Ohio.

(5)"The Engineering Aspects of European Glass Plants," by J. Earl Frazier, Simplex Engineering Co., Washington, Pa.

Saturday, October 24

9:30 A.M.

(6)"A Review of the Reports on Physical Properties of Glass," by Louis Navias, General Electric Co., Schenectady, N. Y.

(7)"Safety Glass in Europe and America," by E. L. Hettinger, Willson Products, Inc., Reading, Pa.

(8)"The Activities of the International Commission on Glass," by J. C. Hostetter, Corning Glass Works, Corning, N. Y.

(9)"My Impressions of European Glass Technology," by Nelson W. Taylor, Pennsylvania State College, State College, Pa.

(10) "Some Impressions of European 'Standard' Methods of Chemical Analyses," by A. N. Finn, National Bureau of Standards, Washington, D. C.

Not more than twenty minutes will be devoted to formal presentations and discussions will follow. Friday evening will be devoted to old-fashioned visiting. For Saturday afternoon, Dr. Scholes has arranged a golf tournament.

A banquet entertainment, novel and funny.

The Riverside Hotel daily rates for individuals including room and meals are as follows: Rooms with running water, $4.00 to $4.50; rooms with running water and toilet, $4.50 to $5.00; rooms with private bath, $5.00 to $5.50.

ART DIVISION PROGRAM

Lord Baltimore Hotel, Baltimore, Md., October 30 and 31

General Theme: "Ceramic Instruction in Secondary Schools"

Friday, October 30, Lord Baltimore Hotel

9:00 A.M.–12:30 P.M.

(1) "Introductory Remarks" by L. E. Barringer (*Chairman, Art Division*), General Electric Co., Schenectady, N. Y.

(2) "Historical" by Charles M. Harder, N. Y. State College of Ceramics, Alfred, N. Y.

(3) "The Ceramic Industry of the United States" by T. A. Klinefelter, National Bureau of Standards, Washington, D. C.

(4) "Educational Values in Clayworking and Ceramics" by Mrs. Mabel C. Brady, Haaren High School, New York, N. Y

(5) "Place of Ceramics in the School Curriculum" by Thomas E. Ryder, Hershey Industrial School, Hershey, Pa.

(6) "Relation of Ceramic Instruction to the Field of Art Education" by Raymond P. Ensign, Executive Director, Natl. Assn. for Art Education.

(7) "Place of Vitreous Enameling in Ceramic Instruction" by H. Edward Winter.

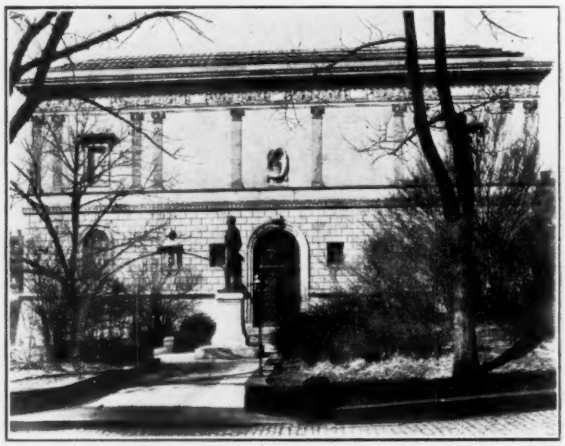
(8) "Types of Pottery and Tile" by A. S. Watts, Ohio State University, Columbus, Ohio.

(9) "Ceramic Sculpture or Modeling" by Mrs. Mabel C. Brady.

(10) "Methods of Instruction" by Luke F. Beckerman, Scarsdale, N. Y.

2:00–5:00 P.M. VISIT TO WALTERS ART GALLERY

Chinese Porcelains and Persian Ware



Walters Art Gallery Exterior View.

8:00 P.M.: BALTIMORE MUSEUM OF ART

(1) Reception by Baltimore-Washington Section, American Ceramic Society

Saturday, October 31, Lord Baltimore Hotel

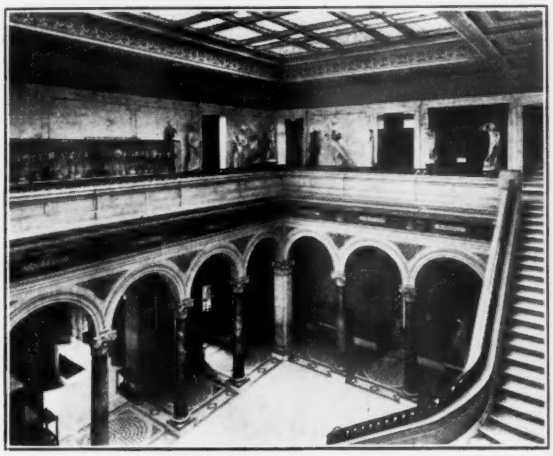
9:00 A.M.–12:30 P.M.

(1) "Introductory Remarks" by Francis C. Flint (*President, American Ceramic Society*), Hazel-Atlas Glass Co., Zanesville, Ohio.

(2) "Space and Equipment Required" by H. R. Bacher, White Cloud Farms, Rock Tavern, N. Y.
(3) "Raw Materials" by A. V. Bleininger, Homer Laughlin China Co., Newell, W. Va.
(4) "Methods of Shaping Ceramic Ware" by H. R Bacher.
(5) "Molds and Mold Making" by W. A. Weldon, Locke Insulator Co., Baltimore, Md.
(6) "Glazes and Glazing" by A. E. Baggs, Ohio State University, Columbus, Ohio.
(7) "Ceramic Decoration" by R. Guy Cowan, Onondaga Pottery Co., Syracuse, N. Y.
(8) "Kilns and Pyrometry" by F. H. Norton, Mass. Institute of Technology, Cambridge, Mass.

Maryland Institute Exterior View.

(9) "Sources of Material" by M. E. Holmes, N. Y. State College of Ceramics, Alfred, N. Y
(10) "Clayworking in Occupational Therapy" by William Russell, Johns Hopkins Hospital, Baltimore, Md.



Maryland Institute Interior View.

2:00–4:00 P.M.: MARYLAND INSTITUTE

A special bus trip is planned to the Freer Art Gallery, Washington, D. C., Sunday morning at 9:00 A.M.

Chinese Porcelain Exhibit in Walters Art Gallery.

Local Committee

The Committee for the Baltimore Meeting is as follows:

W. A. Weldon, Locke Insulator Co., Baltimore, Md.
Roy G. Blunt, Buck Glass Co., Baltimore, Md.
R. Guy Cowan, Onondaga Pottery Co., Syracuse, N. Y.
E. deF. Curtis, Conestoga Pottery, Wayne, Pa.
C. C. Engle, United Clay Mines Corp., Trenton, N. J.
E. B. Filbert, Edward Bennett Pottery, Baltimore, Md.
W. N. Harrison, National Bureau of Standards.
Mildred C. Kingsbury (Mrs.), Docent, Baltimore Museum of art.
T. A. Klinefelter, National Bureau of Standards.
Thomas E. Ryder, Hershey Industrial School.
R. J. McKinney, Director, Baltimore Museum of Art.
George R. Shelton, National Bureau of Standards.
Karl Türk, Porcelain Enamel & Mfg. Co., Baltimore.

Entrance Court, Baltimore Museum of Art.

New building of the Baltimore Museum of Art, opened April 18, 1929.

THE SOCIETY'S LIBRARY SERVICE

An increasing number of persons are taking advantage of the photostat service which the Society renders at cost. Many are borrowing books and back numbers of ceramic trade journals. The books, reports, and clippings on silicosis have traveled often and far and at one time they were held in court as a defense exhibit.

Additions to the library are steadily being made, not by purchase, but by gifts from members of the Society and by review copies from the publishers.

The latest book to be received is the First and Second Annual Reports of the Ohio Geological Survey. It was presented by Howells Fréchette. It was originally owned and was bound by William C. Howells, father of the well-known writer, William Dean Howells. The first report was printed in 1838.

A lecture on "Chemistry and Geology" delivered by John Locke, M.D., on November 6, 1838, before the class of the Medical College of Ohio, Cincinnati, is bound in this volume.

A "catalogue" of the Medical College of Ohio session, 1835–36, which lists William C. Howells as a student from Ross County, Ohio, is also included. The 131 students attending came from sixteen different states, one of which was "Michigan Territory."

THE NEW CONSTITUTION ADOPTED

BALLOT COUNT AS OF SEPTEMBER 3, 1936

Article	For	Against
I	296	1
II	297	0
III	296	1
IV	297	0
V	297	0
VI	297	0
VII	297	0
VIII	295	2
IX	297	0
X	296	1
XI	296	1
XII	296	1
XIII	297	0
XIV	297	0

The new Constitution of the American Ceramic Society appeared in the June issue of *The Bulletin*. Ballots were issued to all members in good standing. The Constitution was declared by President Francis C. Flint on August 10 as carried.

Credit and thanks are due to David H. McKinley, John Milton McKinley, and W. Keith McAfee for drafting the Constitution. They are now working on the proposed By-Laws and Rules.

Discussion Leaders at Fall Meeting, Refractories Division, September 4 and 5.

W. C. Buell, Jr. (left), and J. D. Keller (right).

39th ANNUAL MEETING

HOSTS FOR 1937 ANNUAL MEETING

Hotel Waldorf-Astoria, New York City, N. Y., March 21–27

The following committees were appointed by the New Jersey Ceramic Association to make the next American Ceramic Society Meeting the best that has been held to date.

Executive Committee

Robert B. Sosman, *Honorary Chairman*

V. V. Kelsey, *General Chairman;* George H. Brown, Charles F. Geiger, Fred Sutterlin, Homer F. Staley

Finance Committee

(This is a part of the Executive Committee) H. P. Smith, George Simcoe, in addition to the above.

Publicity and Public Relations Committee

E. V. Eskesen, D. P. Forst, Henry Kleinfeldt, Frank Valentine, C. F. Geiger, Harold Coss.

Exhibit Committee

D. William Scammell, Perry Helser, E. V. Eskesen, Paul Berryman, Martin Stangl, Leslie Brown, Frank Holmes, Arch M. Maddock, G. W. Jarman, Jr.

Meeting Service Committee

John Kauffman.

General Entertainment Committee

R. L. Clare, J. A. Williams, Ira Sproat, Jack Williams, Charles Brian, James Hamilton, Frank Dinsmore, Herreld Thropp.

Entertainment for Ladies Committee

(Includes the wives of the members of this Committee).

Chester Treischel, J. M. Gilfillan, T. H. McKeown, D. William Scammell.

Sight-Seeing and Plant Visitation Committee

George Simcoe, Fred Whittaker, R. F. Sherwood, Harold Humphryes, George Crossley, William Kelley.

J. P. Hoenig of the Waldorf-Astoria Adds His Assurance

"In the week preceding Easter, it is possible for us to care for the requirements of the Society in a manner which we are confident will insure the satisfaction and add to the enjoyment of all those in attendance. Not only would we have an ample number of meeting rooms available, but it would be possible for us to make a reduction in rates which would be as follows:

Single rooms (with bath): $4.50, $5.25, $6.00
Twin bedded rooms (with bath): $7.00, $7.50, $8.25

"A limited number of larger rooms are available for those students and other persons wishing to stay three in a room. The rate will be $3.00 each person per day."

ENAMEL DIVISION PROGRAM FOR 1937 MEETING

Discussion Topics: Black Edge, Hairlines, Cover-Coat Enamels, Adherence, Shorelines, and Copperheads

On July 7, 1936, a questionnaire was sent to members of the Enamel Division requesting their selection of topics for enamel shop problems. The replies are being sent to F. R. Porter, *Chairman, Program Committee* (32 Highland Street, Hammond, Indiana).

The outstanding shop problems as indicated to Mr. Porter are (1) black edge, (2) hairlines, (3) cover-coat blisters, (4) adherence, (5) shorelines, and (6) copperheads. Other problems follow closely, such as (7) heat shock (hollow ware), (8) opacity, (9) furnace atmosphere, and (10) orange peel.

Mr. Porter Urges Choice of Topics for Discussion

"Time will probably permit the discussion of only six topics at our *Round-Table Discussion* at the Annual Meeting. The six chosen topics should represent the most serious enamel shop problems and this can be determined only by a large number of votes.

Sufficient votes have not yet been received to determine this. *Get Your Vote in Now. The Time Is Getting Short.*

The returned cards show that nine papers are already promised for the Meeting and five more are being contemplated. *Shop men* here is your chance to make this *your Meeting.* An early receipt of the title of your paper is essential for planning the program."

F. R. PORTER, *Chairman, Program Committee*

Shop Problems in the Enamel Industry

(1) Adherence defects
(2) Black-edge defects
(3) Ground-coat defects
  (*a*) Copperheads (*b*) Fishscale

(4) Cover-coat problems
- (*a*) Blisters
- (*b*) Pop-offs
- (*c*) Orange peel
- (*d*) Gloss
- (*e*) Opacity
- (*f*) Tearing
- (*g*) Hairlines
- (*h*) Shorelines
- (*i*) Scumming

(5) Furnace problems
- (*a*) Atmosphere
- (*b*) Furnace comeback
- (*c*) Size of charge

(6) Milling problems
- (*a*) Size of charge
- (*b*) Water content
- (*c*) Heat developed

(7) Cleaning and Pickling problems
(8) Drying problems
(9) Spraying problems
(10) Hollow-ware problems
- (*a*) Heat shock
- (*b*) Acid resistance
- (*c*) Antimony in enamels

MEMBERSHIP STATUS

Date of Record	Members Paid: Personal	Members Paid: Corporation	Deferred	Subscriptions	Monthly sales	Total circulation
December 31, 1935	1248	187	26	488	225	2174
September 22, 1936	1365	183	34	491	200	2273

SAILING GOOD SHIP CERAMICS ON PROGRESS RIVER

Additions during September, 1936

Eleven (11) new Personal Members
One (1) new Corporation Member
One (1) additional Subscriber

Changes since September, 1935 (one year)

One hundred forty (140) additional Personal Members
Three (3) fewer Corporation Members
Same number (34) of Deferred Payment Members
Fifty (50) additional Subscribers
Same number (35) Advertisers

Your Job as Purser

The goal is three hundred (300) Corporation Members (our peak record for all time)
There should be seventy (70) Advertisers

NEW MEMBERS

Corporation

CHICAGO VITREOUS ENAMEL PRODUCT CO., D. B. Walters, voter, 1401–47 South 55th Court, Cicero, Ill.
FORD CERAMIC ARTS, INC., Walter D. Ford, voter, 319 West 10th Ave., Columbus, Ohio.
POPE-GOSSER CHINA CO., Frank P. Judge, voter, Coshocton, Ohio.

Personal

BELL, R. RENTON, "Harley" 137 Cambridge Terrace, Christchurch, New Zealand; dental surgeon.
HENDERSON, FREDERICK C., 813 Ohio Ave., East Liverpool, Ohio; Hall China Co.
IRVINE, W. ARTHUR, Falkirk Iron Works, Falkirk, Scotland; superintendent of Enamel Dept.
JOBLING-PURSER, ERNEST J., Wear Glass Works, Sunderland, England; governing director, James A. Jobling & Co., Ltd.
JOHNSTON, PHILIP S., 905 S. Clark St., Mexico, Mo.; ceramic engineer, A. P. Green Firebrick Co.
KARASIN, A. B., Amtorg Trading Corp., 261 Fifth Ave., New York, N. Y.; representative of Light Industries of U.S.S.R.
KELLER, LEWIS H., Owens-Illinois Glass Co., Fairmont, W. Va.
SLYH, JOHN A., National Carbon Co., Fostoria, Ohio; production engineer.
WALSH, DONALD E., Consolidated Feldspar Corp., Kingman, Ariz.; superintendent.
WARREN, BERTRAM E., Massachusetts Institute of Technology, Cambridge, Mass.; Associate Professor of Physics.

Student

CLINE, ROBERT W., Research Fellow, Northwest Experiment Station, U. S. Bureau of Mines, Seattle, Wash.
HENDREN, ROBERT R., Ohio State University.
MOSGO, CHARLES F., Cleveland School of Arts.

Membership Workers' Record

Personal		Corporation	
L. H. Brown	1	Office	3
F. C. Flint	1	**Student**	
V. V. Kelsey	1	J. R. Beam	1
G. H. McIntyre	1	Mrs. A. R. Dyer	1
W. E. S. Turner	1	Hewitt Wilson	1
Office	5		
		Grand Total	16

39th ANNUAL MEETING—MARCH 21–27, 1937

WALDORF-ASTORIA, NEW YORK CITY

LOCAL SECTIONS

MICHIGAN-NORTHWESTERN OHIO SECTION

The Michigan-Northwestern Ohio Section of the American Ceramic Society held for its summer meeting a Stag Party at Lido, St. Clair Shores, Detroit, Mich., on September 18, 1936. L. G. Tait of the Champion Spark Plug Company was in charge of the meeting. Twenty-three members attended.

The Autumn meeting is to be held on November 20 in Detroit. A. E. Baggs, Professor of Fine Arts, in charge of Ceramic Art at Ohio State University, will be the speaker.

—KARL SCHWARTZWALDER, *Secretary-Treasurer*

CALIFORNIA SECTION

Annual "Beer-Bust"

The increasing popularity of the annual social evening of the California Section was attested to when the largest crowd in the history of the Local Section turned out September 18. One hundred and ten members and guests started with dinner at the Hotel Rosslyn after which the party proceeded to the Follies Theatre where entertainment was provided. At the conclusion of the burlesque performance, the party proceeded to take over the "319 Club," at which talented members of the Local Section exhibited their accomplishments as acrobats, dancers, and what have you!

Much of the credit for the success of the party was due to the efforts of the Chairman-Elect for 1937, Elwyn L. Maxson. "Max" has had charge of three of these social evenings, and there is much conjecture as to what surprises he may have in store for the crowd next year, since each succeeding party has been better than the one before.

These annual social evenings of the California Section are organized by a committee, the business of which is to "shakedown" the ceramic supply houses to the tune of a small expense account to pay for entertainment. So successful was this year's committee, composed of Walter Skeoch, of Skeoch and Thomas, assisted by J. G. Stewart of the Braun Corporation, that the attending members were taxed only twenty-five cents each for the entire evening's entertainment, including dinner.

Grateful acknowledgment is made to the following companies who contributed to the success of the evening: Ames Grinding Co., Braun Corp., L. H. Butcher Co., Chamberlain Co., A. J. Lynch Co., Mefford Chemical Co., Elwyn L. Maxson (ceramic raw materials), National Lead Co., Pacific Coast Talc Co., Skeoch and Thomas Co., and Western Talc Co.

—THOMAS S. CURTIS, *Secretary*

THE INTERNATIONAL UNION OF CHEMISTRY

The Twelfth Conference of the International Union of Chemistry was held in Lucerne, Switzerland, August 16 to 22. Alexander Silverman, Head of the Department of Chemistry, University of Pittsburgh, was the official delegate of the American Ceramic Society.

Additional delegates appointed by the National Research Council and the National Academy of Sciences included Edward Bartow, State University of Iowa, *Chairman;* Roger Adams, University of Illinois; Frederick J. Bates, National Bureau of Standards; Wallace R. Brode, Ohio State University; Emma P. Carr, Mt. Holyoke College; John B. Ekeley, University of Colorado; Gustavus J. Esselen, Boston, Mass.; Colin G. Fink, Columbia University; John C. Hostetter, Corning, New York; James F. Norris, Massachusetts Institute of Technology; Austin M. Patterson, Antioch College; Atherton Seidell, National Institute of Health; Robert E. Swain, Stanford University; and Adolph Zimmerli, New Brunswick, N. J.

Other countries represented included Germany, Argentina, Austria, Belgium, Denmark, France, Great Britain, Greece, Italy, Japan, Lithuania, Holland, Peru, Poland, Portugal, Rumania, Sweden, Switzerland, Czechoslovakia, and the U.S.S.R. The civil war in Spain prevented delegates from representing that nation. One hundred and forty-eight delegates were in attendance.

Nicola Parravano of Rome presided; M. Jean Gerard of Paris was Secretary; and Friedrich Fichter of Basel, Switzerland, was Chairman of the Committee on Arrangements. Great credit is due Professor Fichter and his associates for the fine program which was arranged and for their genuine hospitality. Delegates were the guests of the Swiss Republic at all the functions.

The meeting opened Sunday, August 16, with a reception at 6:30 P.M. in the St. Gotthard Hotel. On Monday, August 17, the Council of the Union met at 10 A.M. and at 11:30 there was a general assembly of the Union in the Palais des Congrés; at 2:30 the various committees met. At 6 P.M., M. G. Flusin of Grenoble delivered a lecture on "The Actual State of Electrochemistry and Electrometallurgy." At 8 P.M., the formal opening banquet was held in the Schweizerhof.

On Tuesday, August 18, the various committees held meetings. At 5 P.M., O. Warburg of the Kaiser Wilhelm Institute spoke on "The Constitution and Reactions of Ferments." At 6:30 P.M., E. C. Dodds of London spoke on "Chemical Structure in Relation to Hormone and Biological Activity." At 8:30 P.M., the party was entertained at the Palace Hotel with an evening of popular Swiss art in dance and song.

On Wednesday morning, August 19, the delegates and their families left by special train for Zurich, arriving there

about 9:30. At 10 o'clock, L. Ruzicka spoke on "The Constitution and Function of Sex Hormones," in the old auditorium of the University which Victor Meyer had designed more than fifty years before. At 11:30 A.M., P. Karrer spoke on "Biochemically Workable Plant Colors," in the new lecture hall. The group returned to Lucerne over the mountains in special busses, at times reaching an altitude of 4500 feet, which afforded a superb view of the Vier Waldstatter See, arriving at 8 P.M.

On Thursday, August 20, the Council met at 10 A.M. and the committees at 2:30 P.M. At 5:00 P.M., C. G. Fink of Columbia University spoke on "The Electrochemical Protection of Iron and Steel against Corrosion." At 6:30 P.M., F. Giordani of Naples spoke on "The Electrolysis of Alkali Chlorides," and at 8:30 P.M., the delegates and their families were entertained by the Swiss Ballet.

On Friday, August 21, there was a meeting of the Council at 10 A.M. and again at 2:30 P.M. It was at this session that the Council decided to hold the next (the thirteenth) meeting of the Union in Rome in 1938. At 6 P.M., J. Billiter of Vienna spoke on "The Status and Prospects of Applied Electrochemistry." The closing banquet was held at the National Hotel at 8 P.M.

A special boat left Saturday, August 22, for Vitznau, and the group was taken on cable cars for a trip up Mt. Rigi. Luncheon was provided on the Rigi-Kaltbad. At 5 o'clock, the group descended to Vitznau and made a tour of the Vier Waldstatter See on the special boat.

Delegates were provided with a list of the various international committees and reports on the general state of the Union, together with those of the President, the Secretary, and the Treasurer. Committee reports included the International Committee on Atomic Weights; an official report on "The Analysis of Tannic Acid"; a report on "The Desirability of Unifying the Various Pharmacopœas with a View to Establishing an International Pharmacopœia"; the "1936 International Table of Stable Isotopes"; the report of the International Committee on Thermochemistry; the report of the Committee on Physico-Chemical Constants; the definition of "absolute and comparative physico-chemical units"; and the recommendation of a set of rules covering the publication of articles in various journals. The list of publications also included the official program and a list of official delegates by countries. Within 24 hours of the closing of the last session of the committees, a complete mimeographed report was provided for every delegate.

A special program, arranged for the ladies, included social engagements and sight-seeing tours about Lucerne.

In closing, tribute must be paid once more to Professor Fichter and his associates for the perfect manner in which their program was conducted and for the lavish and hospitable entertainment which they provided. Delegates who attended the Twelfth Conference in Switzerland can never forget the well-ordered life of the Swiss people, the immaculate cleanliness of the cities, the beauty of the natural scenery, and the warm cordiality extended by the Swiss Republic.

—ALEXANDER SILVERMAN, *University of Pittsburgh*

NECROLOGY

PHILIP IGNATIUS HEUISLER

Philip Ignatius Heuisler, President and Chairman of the Executive Committee of the Maryland Glass Corporation, passed away suddenly on Monday evening, August 17, at Franconia, N. H., where he had gone for a vacation. He suffered a stroke and died less than twelve hours later.

Mr. Heuisler was born in Baltimore, February 1, 1871, the son of the late Joseph S. Heuisler (member of the Baltimore Bar) and Katherine McCann Heuisler. He was also a brother of the late Judge Charles W. Heuisler and Dr. Joseph S. Heuisler of Baltimore. Mr. Heuisler was a graduate of Loyola College, Baltimore. He studied pharmacy at the University of Maryland and chemistry at the Johns Hopkins University.

Mr. Heuisler became associated with the late Captain Isaac E. Emerson about forty-six years ago, in the early days of the Emerson Drug Company, manufacturers of Bromo-Seltzer. In 1908, Captain Emerson organized the Maryland Glass Corporation and made Mr. Heuisler its President, which office he continued to hold until the time of his death. Upon the death of Captain Emerson in 1931, Mr. Heuisler became President of the Emerson Drug Company succeeding Joseph F. Hindes, who was made Chairman of the Board of Directors of the Emerson Drug Company and Chairman of the Executive Committee of the Maryland Glass Corporation. When Mr. Hindes died last October, Mr. Heuisler became Chairman of the Executive Committee, retaining the presidency of the Maryland Glass Corporation and Chairmanship of the Board of the Emerson Drug Company.

Mr. Heuisler was also President and Chairman of the Executive Committee of Bromo-Seltzer, Limited, Toronto, Canada; Chairman of the Executive Committee of the Emerson Hotel Company, and Vice-President of the Citro Chemical Company of Maywood, N. J.

He was past-president of the Glass Container Association of America, in which organization he was active for many years. He was also active in the Proprietary Association, the Baltimore Drug Exchange, and the American Pharmaceutical Association.

He was a former president of the Rotary Club, a member of the Knights of Columbus, Maryland Pilgrims Association, Baltimore Country Club, Elkridge Club,

Rolling Road Golf Club, and the Engineers' Club. He was also active as a layman in the affairs of the Catholic Church.

Besides his widow, the former Marie Hilda Gardiner, and his sons, J. Stanley Heuisler, Sales Manager of the Emerson Drug Company, and Philip I. Heuisler, Jr., Assistant Treasurer of the Maryland Glass Corporation, he is survived by seven daughters: Madame Heuisler, a nun at the Sacred Heart Academy, St. Louis; Mrs. Edward A. McCormick, Mrs. George Hebner, Jr., Mrs. Harris Jones, Mrs. Charles M. Rich, Miss Katharine Heuisler, and Mrs. Heuisler Leach; also fourteen grandchildren. A brother, William F. Heuisler of Philadelphia, and a sister, Mrs. Francis E. Tormey of Baltimore, also survive.

Philip I. Heuisler, 1871–1936.

SCHOOL NOTES

UNIVERSITY OF NORTH CAROLINA

Correspondence Course in Ceramics

A. F. Greaves-Walker, head of the Department of Ceramic Engineering at the Raleigh unit of the University of North Carolina, announces that his department, through the College Extension Division, is again offering correspondence courses in ceramic engineering.

Correspondence courses were first offered by the department in 1925, but in 1931 they were discontinued due to lack of funds necessary to revise them and sufficient assistance in the department to carry on the work.

The work of revising the courses has been carried on during the past summer and will be continued until all of them have been brought up to date.

The courses offered include (1) Ceramic Materials, (2) Ceramic Processes, (3) Drying Technology, (4) Firing Technology, (5) Bodies, Glazes, and Colors, (6) Pyrometry, (7) Setting Heavy Clay Products, (8) Metal Enamels, and (9) Refractories. The courses in Enamels and Refractories are still in the course of revision and will not be ready for several months.

Considerable improvement in the handling of the work of correspondence students is anticipated with the appointment of R. L. Stone as instructor in the department to take charge of this branch of instruction.

During the five years the courses were offered, nearly 600 students registered for them. While the majority were residents of this country, students were registered from 15 foreign countries, including far away Australia, New Zealand, Argentina, Chile, Brazil, and South Africa, as well as from practically every European country.

The courses have been made as practical as possible and are designed for practical men in the ceramic industries who have had only a grade or high-school education and wish to improve themselves through home study.

Further information can be obtained from the Department of Ceramic Engineering of the College Extension Division, State College Station, Raleigh, N. C.

CERAMIC RESEARCH AT NEW YORK STATE COLLEGE OF CERAMICS

A New Department

Professor of Research

H. G. Schurecht was graduated in ceramics at the University of Illinois. Later he did graduate work at Ohio State University and the University of Pittsburgh. He was ceramic chemist for the Findlay Clay Pot Co., Washington, Pa., 1914–16; associate ceramic chemist, Bureau of Standards, Pittsburgh, Pa., 1916–17; ceramic chemist, Bureau of Mines, Lord Hall, Ohio State University, Columbus, Ohio, 1917–23; Senior Fellow, Vitrified Salt-Glazed Sewer Pipe Fellowship, National Bureau of Standards, Washington, D. C., 1925–31; and chief chemist, Eastern Terra Cotta Co., Long Island City, N. Y., 1931–36.

Assistant Professor of Research

J. F. McMahon was graduated from Alfred University in 1923 in the Department of Ceramic Engineering. He remained for one year as shop foreman in the Ceramic School. He was employed for one year as ceramic engineer for the Queen's Run Refractory Company at Lock Haven, Pa., leaving Lock Haven to join the Ceramics and Road Materials Division of the Canadian Department of Mines at Ottawa, where he has remained until now. For the past eleven years, Mr. McMahon has been engaged in the study of problems relating to the manufacture and use of ceramic

Harry G. Schurecht, Professor of Research, N. Y. State College of Ceramics, Alfred, N. Y.

products. Mr. McMahon is vice-president of the Canadian Ceramic Society, and a member of the American Ceramic Society and of Keramos Fraternity.

Charles Major Lampman, Assistant, N. Y. State College of Ceramics, Alfred, N. Y.

Assistant

C. M. Lampman was graduated from the New York State College of Ceramics in June, 1936. His training and adaptation particularly fit him for research work.

J. F. McMahon, Assistant Professor of Research, N. Y. State College of Ceramics, Alfred, N. Y.

W. WEYL JOINS CERAMIC INSTRUCTION STAFF AT PENN STATE

Woldemar Weyl was born June 13, 1901, in Darmstadt, Germany, and studied chemistry at the Technische Hochschule of the same town. After obtaining the degree of Dipl.-Ing., he left the Hochschule to accept a position as chemist in an agricultural experiment station for two years. In 1926, he went to Berlin-Dahlem where the Kaiser Wilhelm-Institut für Silikatforschung had been recently founded under the direction of W. Eitel. He worked first on the equilibria between carbon dioxide and silicate melts at high pressures. For this work he received the degree of Dr.-Ing. from the Technische Hochschule in Aachen.

In the Silikatforschung Institut where he later became head of the division of glass research, he worked on purely scientific as well as technological problems.

Scientific Work

(1) Reactions in the solid state, (2) equilibria between carbon dioxide and oxygen with different silicates, (3) studies on the constitution of glass, and (4) on the action of mineralizers.

Technological Investigations

(1) Studies of coloring materials in glass and aqueous solutions (in collaboration with E. Kreidl, E. Thueman,

and H. Pfeilschifter), (2) the dependence of color on the state of oxidation of the coloring oxide, and (3) on the dissociation and association of the solvent.

In collaboration with W.E.S. Turner (Sheffield), he studied the constitution and the color of iron manganese glasses.

In the field of refractories, he studied the formation of magnesia-ferrite in magnesia brick by means of X-ray methods and, with J. H. Chesters, the souring of dead-burned magnesite and the drying of magnesite brick.

Further, he studied the color formation in glazes and, with H. Rudow, developed a new method for the accurate determination of traces of lead. In connection with the Fachausschuss für Fein-Keramik der Deutschen Keramischen Gesellschaft (W. Steger, head), this method was applied to different glazes to study the influence of composition and firing temperature on the amount of lead dissolved by different solvents.

He is now Associate Professor in the Department of Ceramics, the Pennsylvania State College, and is in charge of instruction and research in the field of glass technology. He is giving courses in ceramic petrography, whiteware, and glass, with an advanced course for graduate students on the latter subject.

Woldemar Weyl

COMMUNICATIONS—CERAMIC HISTORY

POTTERY INDUSTRY IN MUSKINGUM COUNTY, OHIO

The plastic clay deposits of Miami and Scioto valleys were used by the Indians for making pottery. Primitive pottery has not been found in Muskingum County, but the Indian Mounds in the Miami and Scioto valleys have many specimens.

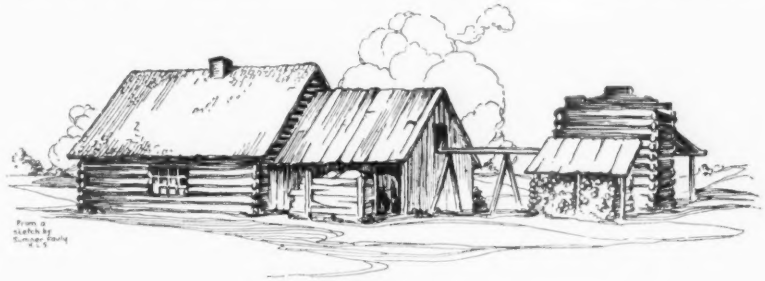
Soon after the white men started settlements a definite need was felt for crocks, jars, tableware, and glassware. Because these common necessities were very expensive when obtained from the East, local plants were started to manufacture them. Zanesville was settled in 1799 and only three years later there were two brick manufacturers and within nine years the first earthenware shop was started.

In Muskingum County were many deposits of plastic clay that were suitable for stoneware purposes. This clay frequently occurred as outcrops in the fields, making it easily accessible. The clay was buff-firing, and being associated with coal beds the potters had a cheap fuel close by.

Only a small outlay of capital was necessary to start a pottery, and many of the potters were farmers at the same time. During the winter they would make the pottery; then in the summer they would hire young men to float it down the Ohio and Mississippi rivers on barges. A great deal of the ware was carried as far south as New Orleans. The men would sell the ware and finally the barges and then work their way back to Ohio.

Whiteware

In 1808, Samuel Sullivan started the first plant for making earthenware in this district, and he was followed by



Samuel Weller's First Pottery.

Joseph Rosier in 1814. After this many plants were started until, in 1840 according to the United States Federal Census, there were 99 potteries in this State employing 199 men with a total investment of $43,450. Of these, Muskingum County had 22 potteries, 66 men employed, and $17,900 invested. The counties following the

closest were Stark with 11 potteries, 12 men, and $1395 invested; and Summit with 5 potteries, 17 men, and $4600 invested.

Between the years 1870 and 1880, the manufacture of culinary or earthen cooking- and serving-ware was started in the State. In 1878, A. H. Bodin of Roseville held patents on the manufacture of this type of ware. Lyman Lowry in 1882 made culinary ware called "asbestos cooking ware," in which asbestos was reported to have been incorporated with the plastic fire clay of the body.

S. A. Weller

Samuel A. Weller in 1872 founded a plant at Fultonham.[1] This was a rude log cabin and the traditional white horse was used to haul the clay in on week days. On Sunday the horse was used by the workmen to aid their courting.

In 1888, the plant was transferred to Zanesville and located in Putnam. An addition was made in 1893; two years later the plant was destroyed by fire but it was immediately rebuilt.

[1] See *Bull. Amer. Ceram. Soc.*, **4** [11] 625 (1925) for history of Mr. Weller, who died October 4, 1925.

"Lonhulda" ware, for which the Weller Pottery Company first became famous, was developed by A. W. Long, who came from Steubenville and remained one year.

In 1900, the Weller Company purchased the plant of the American Encaustic Tiling Company on Marietta Street to make such products as cooking and kitchen ware and common flowerpots.

In 1901, Jacques Sicard of Wolfe Jaran, France, and his assistant, Henri Gallie, were employed and the famous "Sicardo" ware was made. This is a metallic luster worked into designs and up to the present time has not been reproduced.

In 1904, a model pottery was shown at the St. Louis Exposition.

The Zanesville Art Pottery was purchased in 1920. This was destroyed by fire in 1927 and rebuilt on Ceramic Avenue with a modern plant. The Weller Pottery Company is the oldest operating art pottery company in the United States. It enjoys a world-wide reputation for art and utility ware.

—JOSEPHINE GITTER, *Zanesville, Ohio*

JOINT MEETING OF THE FOUNDER SOCIETIES OF THE AMERICAN INSTITUTE OF PHYSICS

October 29 to 31, Hotel Pennsylvania, New York, N. Y.

This meeting of the American Physical Society, Optical Society of America, Acoustical Society of America, Society of Rheology, and American Association of Physics Teachers, to be held at the time of the Fifth Anniversary of the American Institute of Physics, will consist partly of the regular papers of the separate Societies and partly of sessions in which all of the Societies will participate jointly. The joint sessions will emphasize the applications of physics in the industrial world of today.

Thursday, October 29

10:00 A.M.

Symposium on "The Training of Physicists for Industrial Positions," sponsored by the American Association of Physics Teachers

(1) "From the Point of View of the Educator" by Homer L. Dodge, Univ. of Oklahoma.
(2) "From the Point of View of the Employer" by A. R. Olpin, Kendall Mills.

2:30 P.M.

Symposium on "Physics in Industry, Part I"

(1) "What the Industrial Physicist Has Accomplished in the Glass Industry" by E. C. Sullivan, Corning Glass Works.
(2) "Physics in the Metals Industry" by Zay Jeffries, General Electric Co.
(3) "Let the Physicist Change Your Oil" by Paul D. Foote, Gulf Research and Development Co.
(4) "Vibration in Industry" by J. P. Den Hartog, Harvard University.

Friday, October 30

10:00 A.M.

Symposium on "Physics in Industry, Part II"

(1) "Building—The Forgotten Child of Physics" by John Ely Burchard, Bemis Industries, Inc.
(2) "A Problem in Communication—The Evolution of the Crystal-Wave Filter" by O. E. Buckley, Bell Telephone Lab.
(3) "Physics in Air Transportation" by Clark B. Millikan, California Inst. of Technology.
(4) "Some Problems in the Electrical Power Industry" by Joseph Slepian, Westinghouse Electric & Mfg. Co.

On Friday afternoon and Saturday morning and afternoon (October 30 and 31), the programs will be arranged by the individual Founder Societies.

A special program of invited papers is being arranged by the Acoustical Society of America. Prominent among the speakers will be Erwin Meyer, of the Berlin Technische Hochschule and the Instituts für Schwingungsforschung, who will speak on "Reverberation and Absorption" and on "Vibration."

On Saturday morning, the Metropolitan Section of the American Physical Society has arranged a Symposium on "The Solid State." The speakers are Irving Langmuir of the General Electric Co., P. W. Bridgman of Harvard University, and Richard M. Bozorth of the Bell Telephone Lab.

On Friday evening, there will be a joint dinner of all Founder Societies (address to be announced later).

WRIGHT IS WRONG*

By F. W. Preston

Among the scant library of books in the English language on glassmaking, the excellent monograph of F. E. Wright on The Manufacture of Optical Glass and of Optical Systems[1] holds an honored place. Though nominally an account of war-time experiments, the book is practically the only satisfactory work we have on optical glassmaking, and though it is ten years since it was printed, it is still the only thing we have remotely approaching a textbook.

In reading the book through again recently, the present writer found a couple of curious expressions, and as a matter of record, hereby takes exception to them.

On page 37: "Glass under strain is not in equilibrium; and even at room temperature the internal stresses seek relief by slow movement within the glass block. In a highly strained piece of glass the internal movement may reach some mechanically weak spot in the glass mass, such as a stria or an inclusion that is not able to maintain the stress; the result is then a rapid shearing and consequent fracture."

The mechanism of fracture above envisaged may possibly be not far from the truth; in our present ignorance it is impossible to say. But the term "shearing" is here used in some unusual sense. The fracture is apparently looked upon as following after the "shearing," so that the shearing is not the fracturing itself. The term "shearing" in any case, however, is not used in its usual technical sense.

On page 162 we meet with an even more peculiar expression: "The foregoing explanation of the formation of cracks is not complete and does not account adequately for the fact that in a properly cracked pot of glass a master vertical plane fissure divides the part (? pot) into halves. The formation of the other joint cracks, roughly perpendicular to the master joint-plane, is readily deduced from symmetry relations and the existing tensional shearing stresses."

The expression "tensional shearing stresses" being a contradiction in terms, the present author wrote Dr. Wright as to its significance.[2] Dr. Wright replied[3] that he thought the term a common one in treatises on elasticity, but has not up to the present cited an instance where it may be found. He added that he was thinking of anisotropic stresses, in which tensions and shears may co-exist, but this would not justify so strange an expression; nor is there any evidence that the concurrent presence of the two sets of stresses has any particular bearing on the fractures.

On page 162 we also find: "Cracks form slowly and with reference to the distribution of the shearing stresses involved."

On page 161 and elsewhere, reference is made to dangerous "tensional stresses," whose amounts are indeed calculated in specific instances.

From these considerations and the general drift of the argument, I am inclined to think that at the time Dr. Wright wrote the book he was not thinking of "shearing" stresses in the ordinary theory-of-elasticity significance at all, in spite of his recent letter. The term "shearing" as used in the last two references seems to mean simply "apt-to-produce fracture," and substantially the same idea is present in the first reference.

Butler, Pennsylvania

* Received March 27, 1935.

[1] *Ordnance Dept. Document*, No. 2037. Govt. Printing Office, 1924.

[2] October 2, 1934. [3] October 22, 1934.

RESULTS OBTAINED IN A LENOX WALKING-BEAM KILN*

By Leonard S. Briggs

To attempt to control the flow of combustion gases through the ware, particularly in the fusing period, which flow is the medium of carrying away the volatilized lead, it was decided to confine the control of the combustion gases with the ware to the preheat section of the kiln and to change the heat application in the high heat zone to one of radiation. Accordingly, a Carbofrax top was placed in the high heat section. The gases from the burners then make a complete cycle around the kiln and emerge in the kiln chamber at the beginning of the preheat section. The open firing in the preheat section was continued because of the advantages to be gained in securing equal distribution of temperatures in the heating-up period. The products of combustion entering the high heat section were limited to those which entered during the movement of the beams. Since the burners operated on a minimum combustion during this operation, the volume of gases entering was small during the fifteen seconds the beams were in a raised position.

The kiln was operated on this basis for a period of eight months. The results obtained indicated that glaze volatilization had been cut down and that the production of flat ware was nearing perfection. The hollow-ware production continued to be of a high standard. The flat ware, however, continued to offer a problem in that consistency was not possible. While the flat ware with small areas, such as saucers, small plates, etc., could be fired with assured success, the large dinner plates, chop plates, etc., showed a variation which indicated that in the soaking period there might be a shortage of time necessary to produce a uniform glaze texture. There was a tendency of the large plates to craze after they had been drawn from the kiln. An increase in the temperature caused an increase in glaze volatilization, as indicated by pock marking, etc. To produce a longer soaking period by increasing the time cycle would have cut down pro-

* Presented at the Annual Meeting, American Ceramic Society, Columbus, Ohio, March 31, 1936 (Ceramic Ware Firing Symposium). Supplement to Leonard S. Briggs, "Modernizing the Oldest Mechanical Art," *Amer. Gas Assn. Proc.*, 680 (1934); *Ceram. Abs.*, **14** [11] 288 (1935).
Received April 3, 1936.

duction to the point where the kiln would not have been economical to fire. It was also indicated that the soaking period terminated too abruptly, allowing rapid cooling after leaving the high heat section.

To correct this last phase, it was decided to shift the high heating section of the kiln toward the cooling end of the kiln and to place the burners in the high heat section so that there would be a tapering off of the high heat. To relieve the first cooling, burners of lower capacity than those used in the high heat section were added to the high heat section on the cooling side. These changes increased the available soaking length by three feet. The Carbofrax muffle in the high heat zone was extended another two feet past the last burners, so that there was some radiant heat applied in the cooling section. While it was desired to increase the length of the high heat zone to a greater extent, it was not possible owing to the design of the kiln.

On this basis, the kiln was started in October, 1935, and has continued to operate on what we consider to be perfect working conditions. Flat ware as well as hollow ware can be run through in 24 hours, with perfect assurance that the glazing will be correct. The maximum variation in the temperature is about 1/4 cone. This variation exists in the middle of the bottom of the loaded section and can be corrected by changing the design of the beams and pier blocks. Such a small variation, however, does not have any noticeable effect on our decorating operation.

The kiln operates on a 24-hour cycle, and produces 288 cu. ft. of ware in that time. It requires 125 cu. ft. of 525 B.t.u. gas to fire 1 cu. ft. of ware at cone 3. The placing, drawing, firing, and inspection of the kilns require the services of one operator. The placing of hollow ware requires accuracy and therefore time, and with this type of ware, the operator is kept busy. On the flat ware, however, kilns of much larger capacity could be operated with one man, owing to the ease of placing and drawing the specially designed flat-ware furniture.

It has required more than three years to bring this kiln to its present state of perfection. In summing up our experience, the following can be said:

(1) The construction of a complete open-fired kiln for glaze purposes has not been possible, and the complete fulfillment of the project has not been obtained. It can be stated, however, that the worst possible open-firing glazing was attempted. Whether the fulfillment of the project can be accomplished by different heat application and different glazing conditions can not be stated.

(2) The walking-beam principle of travel through a continuous kiln has proved to be practical. It provides not only an easy method of travel but also a safe one. This is especially true of relatively light loads and in kilns of short lengths, possibly up to 100 feet, at any temperatures above a decorating heat. At low decorating heats, the walking beam would not prove any better than the roller type.

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Time	Saturday	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday
Forenoon			General Session	Division Meetings	Division Meetings	Division Meetings Trips	Trips
Noon		Board of Trustees and Committee Luncheons	(1) School Reunions (2) Committee C-8	Division Luncheons	General Committee Business Luncheon Meetings		
Afternoon	Board of Trustees	3:00 p.m. Ceramic Educators	4:00 p.m. Fellow Business Meeting	Division Meetings	Division Meetings	Trips	Trips
Dinner				Keramos Dinner Meeting	Dinner Dance All Evening		
Evening		Small Concert	Get-Together Party	8:00 p.m. Installation of Officers 9:00 p.m. Orton Memorial Fellow Lecture	Dinner Dance		

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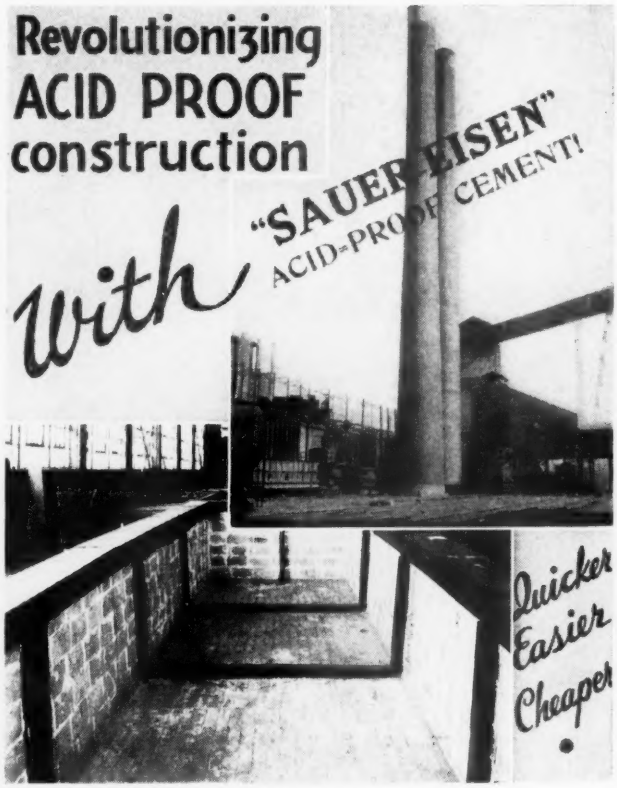

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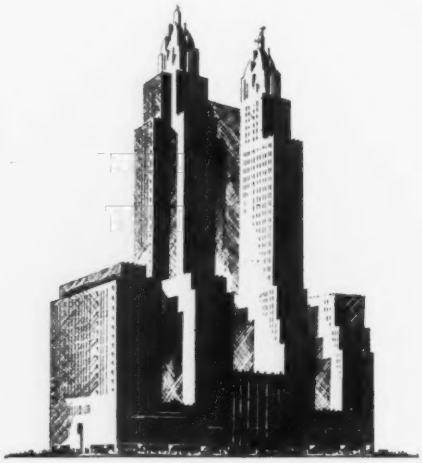

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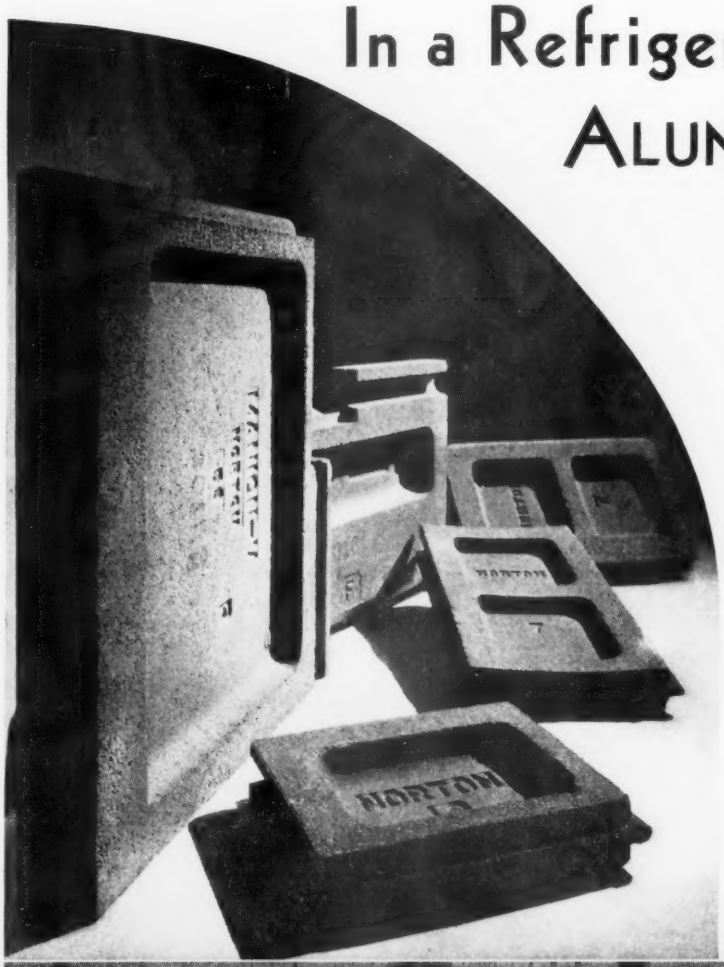

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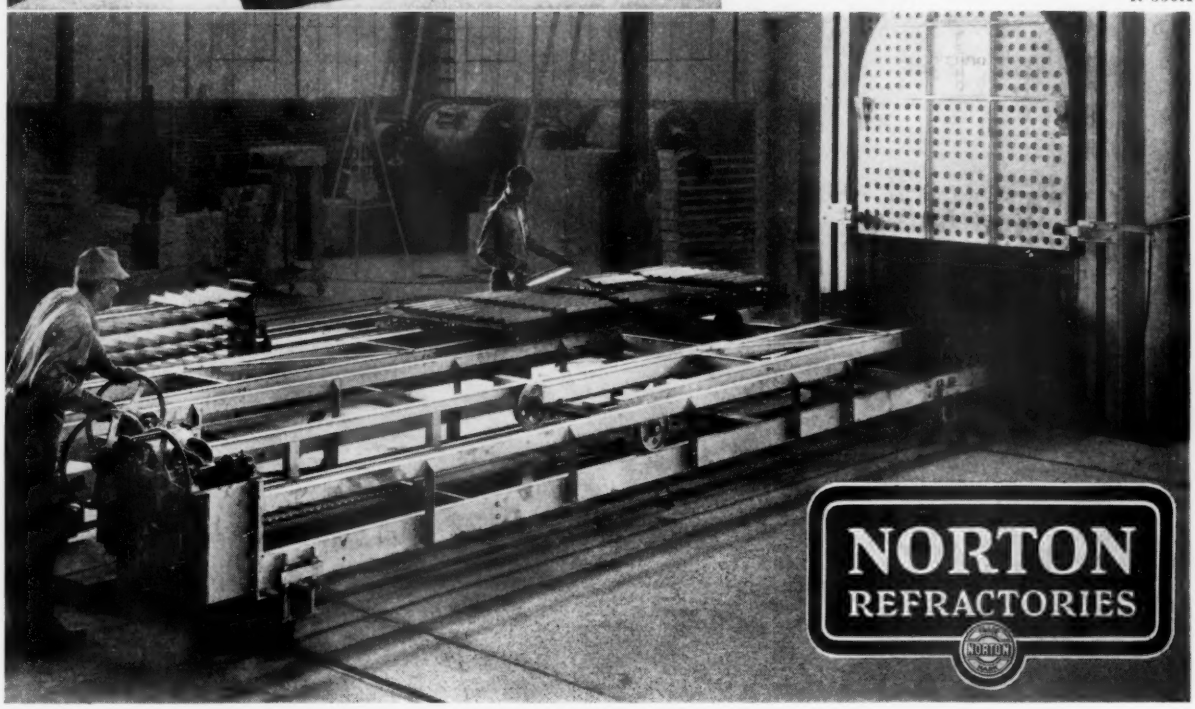

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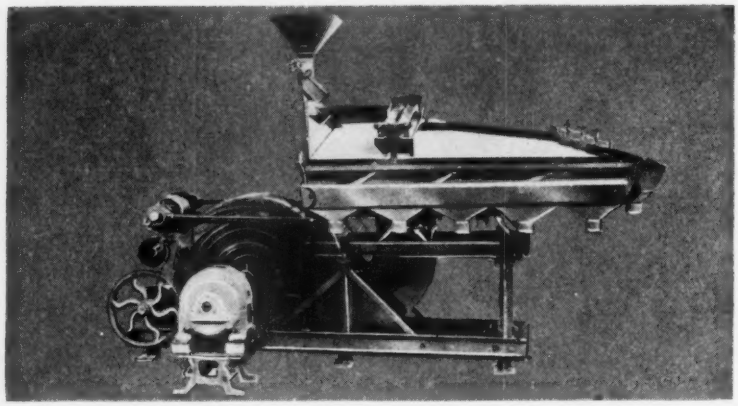

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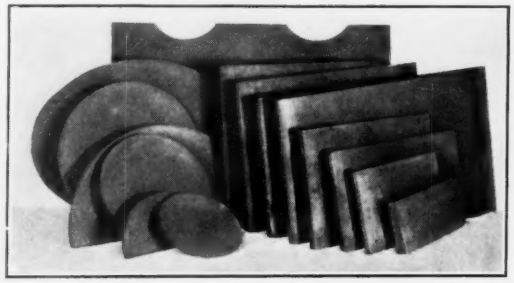

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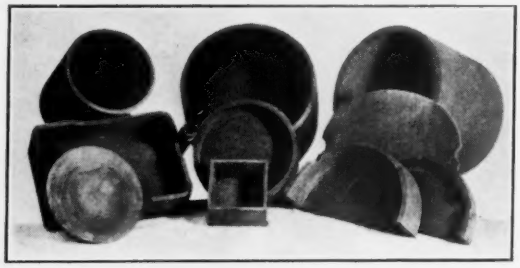

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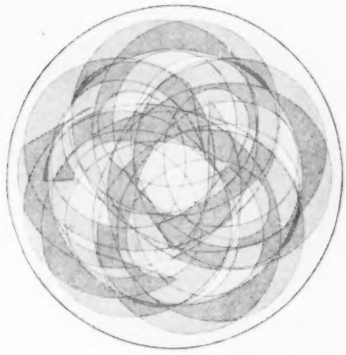

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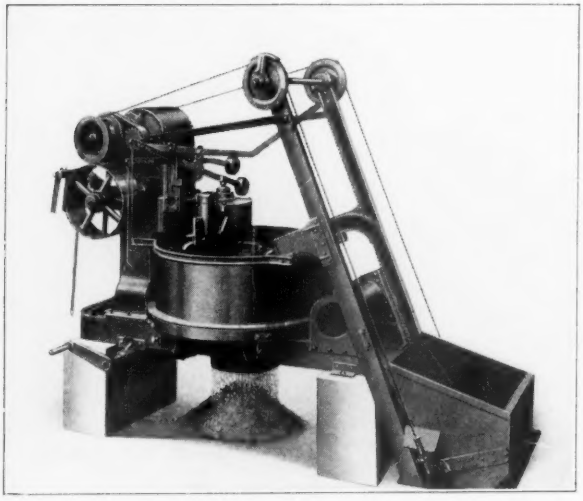

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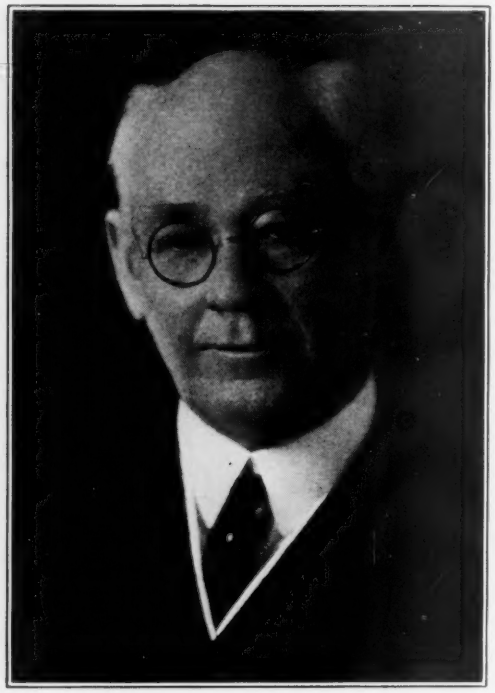

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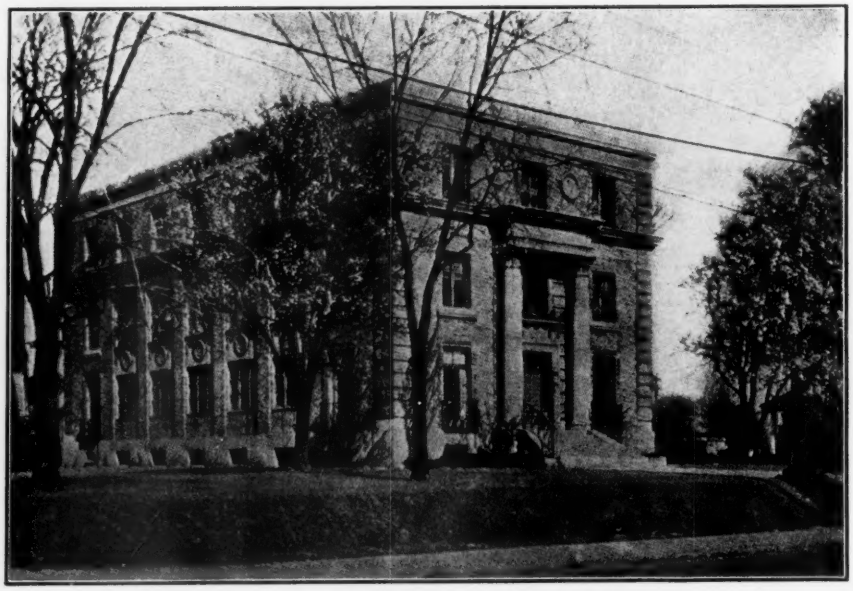

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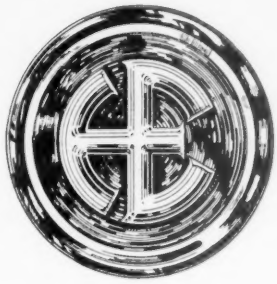

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Barium Carbonate
Bone Ash
Boracic Acid
Borax
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Cerium Hydrate
Chrome Oxide Green
Clay Vallender
Cobalt Oxide Black
Cobalt Sulphate
Copper Carbonate
Copper Oxides
Epsom Salts
Glass Decolorizers
Iron Chromate
Iron Oxides
Iron Sulphide
Japanese Ochre Calcined
Lead Chromates
Lepidolite
Manganese Carbonate
Manganese Chloride
Magnesium Carbonate
Manganese Dioxide
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Nickel Carbonate
Nickel Oxides
Nickel Sulphate
Ochres
Polishing Rouges
Potassium Carbonate
Potassium Chromate
Potassium Bichromate
Powder Blue
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Sodium Bichromate
Sodium Selenite
Sodium Silico Fluoride
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Miners and Shippers of

BALL, SAGGER AND WAD CLAY

NEWPORT, KENTUCKY

October 1, 1936

Mr. Pete Potter

Comfortable Sanitary Pottery Mfg. Co.

Pottsville, Ohio

Dear Pete:

I don't know whether you realize it or not, but Ball Clay at the prices we sell it is not a high priced raw material. We handle more than six tons of material to get to ship you one ton. In order to be sure we can continue to give you the DRY CLAY of the UNIFORM QUALITY that you have come to consider a necessity since you have used SPINKS CLAYS, we must continue to invest a large amount of time and money in testing and proving our deposits and building up tremendous inventories of clay in storage.

Now the point I am trying to make, Pete, is that the last time I was in to see you, you were doing some very interesting work on increasing the use of our clays in your plant, and today I would like to be at your plant talking to you about it, but QUALITY and SERVICE come first and right now I must be down here helping the boys get ready for a long hard winter.

We appreciate your interest in our materials, Pete, and know that if you will keep on working with SPINKS CLAYS you will develop improvements in your finished product and further savings in raw material and production cost.

Sincerely,

Dick Carothers

General Manager
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